

(19)日本国特許庁 (J P)

(12) 公 開 特 許 公 報 (A)

(11)特許出願公開番号

特開平9-102568

(43)公開日 平成9年(1997)4月15日

(51)Int.Cl.⁶

H 0 1 L 23/473

識別記号

庁内整理番号

F I

H 0 1 L 23/46

技術表示箇所

Z

審査請求 未請求 請求項の数9 O L (全 15 頁)

(21)出願番号 特願平7-258750

(22)出願日 平成7年(1995)10月5日

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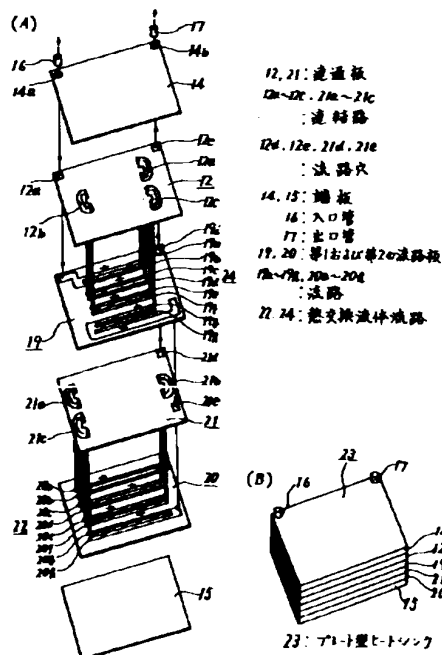
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(54)【発明の名称】 プレート型ヒートシンク

(57)【要約】

【課題】 被冷却電気部品の電気特性にばらつきが生じ信頼性が低下する。

【解決手段】 複数の独立した流路19a~19h、20a~20hがスリット状に並行して形成された複数の流路板19、20と、各流路板19、20と交互に積重され各流路の相隣なる端部同士を交互に連結することにより各流路を連通して熱交換流体流路22、24を形成する複数の連結路12a~12c、21a~21cが形成された複数の流通板12、21と、各流路板および流通板を両側から挟持しいずれか一方に各熱交換流体流路の入口および出口が形成された一対の端板14、15とを備え、各熱交換流体流路を流れる熱交換流体の流動経路が相隣なるもの同士で逆パターンとなるように各熱交換流体流路を連通させる。



【特許請求の範囲】

【請求項1】 複数の独立した流路がスリット状に並行して形成された流路板と、上記流路板に積重され上記各流路の相隣なる端部同士を交互に連結することにより上記各流路を連通して熱交換流体流路を形成する複数の連結路が形成された連通板と、上記流路板および連通板を両側から挟持する一対の端板とを備えたことを特徴とするプレート型ヒートシンク。

【請求項2】 複数の独立した流路がスリット状に並行して形成された複数の流路板と、上記各流路板と交互に積重され上記各流路の相隣なる端部同士を交互に連結することにより上記各流路を連通して熱交換流体流路を形成する複数の連結路が形成された複数の連通板と、上記各流路板および連通板を両側から挟持する一対の端板とを備え、上記各熱交換流体流路を流れる熱交換流体の流動経路が相隣なるもの同士で逆パターンとなるように上記各熱交換流体流路を連通させたことを特徴とするプレート型ヒートシンク。

【請求項3】 複数の独立した流路がスリット状に並行し且つ相隣なるものの上記流路同士の投影断面が重ならない位置に形成された複数の流路板と、上記各流路板と交互に積重され上記各流路の相隣なる端部同士を交互に連結することにより上記各流路を連通して熱交換流体流路を形成する複数の連結路が形成された複数の連通板と、上記各流路板および連通板を両側から挟持する一対の端板とを備え、上記各熱交換流体流路を連通させたことを特徴とするプレート型ヒートシンク。

【請求項4】 複数の独立した流路がスリット状に並行して形成された複数の流路板と、上記各流路板と交互に積重され上記各流路の相隣なる端部同士を交互に連結することにより上記各流路を連通して熱交換流体流路を形成する複数の連結路が形成された複数の連通板と、上記各流路板および連通板を両側から挟持する一対の端板とを備え、上記各熱交換流体流路を流れる熱交換流体の流通方向をその流動経路が相隣なるもの同士で逆パターンとなるようにしたことを特徴とするプレート型ヒートシンク。

【請求項5】 複数の独立した流路がスリット状に並行して形成された流路板と、上記流路板の一侧に積重され上記流路の奇数番目の各一端側および偶数番目の他端側をそれぞれ連結し第1の並列熱交換流体流路を形成する少なくとも一対の連結路が形成された第1の連通板と、上記流路板の他側に積重され上記流路の偶数番目の各一端側および奇数番目の他端側をそれぞれ連結し第2の並列熱交換流体流路を形成する少なくとも一対の連結路が形成された第2の連通板と、上記第1および第2の連通板を両側から挟持する一対の端板とを備え、上記第1および第2の並列熱交換流体流路を流れる熱交換流体の流通方向を逆にしたことを特徴とするプレート型ヒートシンク。

【請求項6】 流路壁の一部に突起を形成するとともに上記突起の高さ寸法の5～12倍の寸法だけ熱交換流体の流れの下流側の位置が中心となるように発熱電子部品を搭載したことを特徴とする請求項1ないし5のいずれかに記載のプレート型ヒートシンク。

【請求項7】 突起は連通板の表面に形成された切り起し部分を折り曲げることによって形成されていることを特徴とする請求項6記載のプレート型ヒートシンク。

【請求項8】 各流路と連結路との連結部に熱交換流体の流れに沿って傾斜を設けたことを特徴とする請求項1ないし5のいずれかに記載のプレート型ヒートシンク。

【請求項9】 流路の一部に幅狭小部が形成されていることを特徴とする請求項1ないし5のいずれかに記載のプレート型ヒートシンク。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】この発明は、例えば電子部品等のように発熱を伴う機器に適用して発生する熱を除去するプレート型ヒートシンクに関するものである。

【0002】

【従来の技術】図15は例えば特公平6-76872号公報に示されるこの種の従来のプレート型ヒートシンクの構成を示す分解斜視図、図16は図15におけるプレート型ヒートシンクの外観を示す斜視図である。図において、1は熱交換流体が流れる流路1aが形成された流路板、2、3はこの流路板1を両側から挟持する端板で、一方の端板2には流路板1の流路1aの入口側および出口側にそれぞれ連通する穴2a、2bが形成されている。4、5はこれらの穴2a、2bに連結される入口管および出口管であり、これらは図16に示すように例えばろう付け等により一体に組み立てられプレート型ヒートシンク10を構成する。

【0003】上記のように構成された従来のプレート型ヒートシンクでは、端板3に絶縁基板等を介して発熱を伴うLSI等の電子部品（図示せず）が搭載される。そして、入口管4から熱交換流体が流入され流路板1に形成された流路1aを流通させた後、流出管5から流出させることにより、端板3を介して熱交換流体と電子部品との間の熱交換を行い電子部品は冷却される。なお、図示はしないが出口管5から流出された熱交換流体は、出口管5に接続された配管を介して冷却装置に導かれて冷却され、ポンプにより再び入口管4からプレート型ヒートシンク10内に流入される。

【0004】

【発明が解決しようとする課題】従来のプレート型ヒートシンクは以上のように構成されているので、流路1aが細く流路板1内を蛇行するような場合、流路1aにより流路板1の強度が小さくなり、自重により流路1aが曲がって不良品が発生するという問題点があった。

【0005】又、流路1a内を流れる熱交換流体は熱交

換によって下流ほど温度が上昇するため、端板3に搭載された電子部品も同様に下流側に搭載されているものほど温度が上昇する。その結果、電子部品の温度は搭載位置によってばらつく。一方、電子部品の電気特性は温度に強く影響されるため、電子部品の温度がばらつくとその電気特性にもばらつきが生じ、所定の性能を発揮できなくなり信頼性が低下するという問題点があった。

【0006】又、電子部品の温度のばらつきを小さくするために、熱交換流体の流量を増大させて熱交換流体自身の温度上昇を低減させるということも可能であるが、この方法によると、流量および圧力損失が増大するため循環させるためのポンプが大型化し、コスト的にも省スペース性の観点からも不利になるという問題点があった。

【0007】さらに又、流路1aを複雑に蛇行させることは加工上困難であり、特に立体的な経路を形成することは困難であるため、冷却性能の向上を図ることが困難であるという問題点があった。

【0008】この発明は上記のような問題点を解消するために成されたもので、不良品発生防止、搭載機器の信頼性および冷却性能の向上を図ることが可能なプレート型ヒートシンクを提供することを目的とするものである。

【0009】

【課題を解決するための手段】この発明の請求項1に係るプレート型ヒートシンクは、複数の独立した流路がスリット状に並行して形成された流路板と、流路板に積重され各流路の相隣なる端部同士を交互に連結することにより各流路を連通して熱交換流体流路を形成する複数の連結路が形成された連通板と、流路板および連通板を両側から挟持する一対の端板とを備えたものである。

【0010】又、この発明の請求項2に係るプレート型ヒートシンクは、複数の独立した流路がスリット状に並行して形成された複数の流路板と、各流路板と交互に積重され各流路の相隣なる端部同士を交互に連結することにより各流路を連通して熱交換流体流路を形成する複数の連結路が形成された複数の連通板と、各流路板および連通板を両側から挟持する一対の端板とを備え、各熱交換流体流路を流れる熱交換流体の流動経路が相隣なるもの同士で逆パターンとなるように各熱交換流体流路を連通させたものである。

【0011】又、この発明の請求項3に係るプレート型ヒートシンクは、複数の独立した流路がスリット状に並行し且つ相隣なるものの流路同士の投影断面が重ならない位置に形成された複数の流路板と、各流路板と交互に積重され各流路の相隣なる端部同士を交互に連結することにより各流路を連通して熱交換流体流路を形成する複数の連結路が形成された複数の連通板と、各流路板および連通板を両側から挟持する一対の端板とを備え、各熱交換流体流路を連通させたものである。

【0012】又、この発明の請求項4に係るプレート型ヒートシンクは、複数の独立した流路がスリット状に並行して形成された複数の流路板と、各流路板と交互に積重され各流路の相隣なる端部同士を交互に連結することにより各流路を連通して熱交換流体流路を形成する複数の連結路が形成された複数の連通板と、各流路板および連通板を両側から挟持する一対の端板とを備え、各熱交換流体流路を流れる熱交換流体の流通方向をその流動経路が相隣なるもの同士で逆パターンとなるようにしたものである。

【0013】又、この発明の請求項5に係るプレート型ヒートシンクは、複数の独立した流路がスリット状に並行して形成された流路板と、流路板の一侧に積重され流路の奇数番目の各一端側および偶数番目の他端側をそれぞれ連結し第1の並列熱交換流体流路を形成する少なくとも一対の連結路が形成された第1の連通板と、流路板の他側に積重され流路の偶数番目の各一端側および奇数番目の他端側をそれぞれ連結し第2の並列熱交換流体流路を形成する少なくとも一対の連結路が形成された第2の連通板と、第1および第2の連通板を両側から挟持する一対の端板とを備え、第1および第2の並列熱交換流体流路を流れる熱交換流体の流通方向を逆にしたものである。

【0014】又、この発明の請求項6に係るプレート型ヒートシンクは、請求項1ないし5のいずれかにおいて、流路壁の一部に突起を形成するとともに突起の高さ寸法の5〜12倍の寸法だけ熱交換流体の流れの下流側の位置が中心となるように発熱電子部品を搭載したものである。

【0015】又、この発明の請求項7に係るプレート型ヒートシンクは、請求項6において、突起は連通板の表面に形成された切り起し部分を折り曲げることによって形成したものである。

【0016】又、この発明の請求項8に係るプレート型ヒートシンクは、請求項1ないし5のいずれかにおいて、各流路と連結路との連結部に熱交換流体の流れに沿って傾斜を設けたものである。

【0017】又、この発明の請求項9に係るプレート型ヒートシンクは、請求項1ないし5のいずれかにおいて、流路の一部に幅狭小部を形成したものである。

【0018】

【発明の実施の形態】

実施の形態1. 図1はこの発明の実施の形態1におけるプレート型ヒートシンクの構成を示し、(A)は分解斜視図、(B)は外観を示す斜視図である。なお、図中矢印は熱交換流体の流通方向を示す。図において、11は複数の流路11aないし11hがスリット状に並行して形成された流路板、12はこの流路板11に積重される連通板で、流路板11の各一対の流路11a、11bと流路11c、11dの各一端に対応して配設され各一端

同士を連結する連結路12a、各一对の流路11c、11dと流路11e、11fの各他端に対応して配設され各他端同士を連結する連結路12b、各一对の流路11e、11fと流路11g、11hの各一端に対応して配設され各一端同士を連結する連結路12c、および縁部には一对の流路穴12d、12eがそれぞれ形成されている。

【0019】そして、これら各連結路12aないし12cにより各流路11aないし11hが連通されることにより熱交換流体流路13が形成される。14、15はこれら流路板11および連通板12を両側から挟持する一对の端板で、一方の端板14には両流路穴12d、12eを介して、両流路11a、11bの他端側および両流路11g、11hの一端側とそれぞれ連通する穴14a、14bが形成されている。16、17はこれら各穴14a、14bにそれぞれ連結される入口管および出口管であり、これらは図1(B)に示すように、例えばろう付け等により一体に組み立てられプレート型ヒートシンク18が構成される。

【0020】上記のように構成された実施の形態1におけるプレート型ヒートシンク18では、まず、端板15に絶縁基板等を介して発熱を伴うLSI等の電子部品(図示せず)が搭載される。次いで、入口管16から熱交換流体が流入されると、熱交換流体は穴14aおよび流路穴12dを介して両流路11a、11bの他端側に流入し、両流路11a、11bを分流した後連結路12aで一旦合流して両流路11c、11dの一端側に流入し、両流路11c、11dを分流した後連結路12bで再び合流して両流路11e、11fの他端側に流入する。

【0021】そして、両流路11e、11fを分流した後連結路12cで合流して両流路11g、11hの一端側に流入し、両流路11g、11hを分流した後他端側で合流されて流路穴12eおよび穴14bを介して出口管17から流出される。このようにして各流路11aないし11h、すなわち熱交換流体流路13を流通する間に端板15を介して熱交換流体と電子部品との間の熱交換が行われ電子部品は冷却される。なお、出口管17から流出された熱交換流体は、図示はしないが出口管17に接続された配管を介して冷却装置に導かれて冷却され、ポンプにより再び入口管16側に循環されプレート型ヒートシンク18内に流入される。

【0022】このように上記実施の形態1によれば、熱交換流体流路13を、流路板11に形成された複数の独立したスリット状の流路11aないし11hと、連通板12に形成されこれら各流路11aないし11hの相隣なる端部同士を交互に連結する連結路12aないし12cとで構成しているため、熱交換流体流路13の形状が比較的簡素化され流路板11の強度も十分に確保できるため、自重で曲がって不良品が発生するのを防止するこ

とができる。

【0023】実施の形態2. 図2はこの発明の実施の形態2におけるプレート型ヒートシンクの構成を示し、(A)は分解斜視図、(B)は外観を示す斜視図である。なお、図中矢印は熱交換流体の流通方向を示す。図において、図1に示す実施の形態1と同様な部分は同一符号を付して説明を省略する。19は複数の流路19aないし19hがスリット状に並行して形成され、また、縁部の連通板12の流路穴12eと対応する位置に流路穴19iが形成された第1の流路板で、各流路19aないし19hは各連結路12aないし12cで連結されて熱交換流体流路24を構成する。20は第1の流路板19と同様に複数の流路20aないし20hがスリット状に並行して形成された第2の流路板である。

【0024】21は第1および第2の流路板19、20間に介在される第2の連通板で、流路板20の各一对の流路20a、20bと流路20c、20dの各一端に対応して配設され各一端同士を連結する連結路21a、各一对の流路20c、20dと流路20e、20fの各他端に対応して配設され各他端同士を連結する連結路21b、各一对の流路20e、20fと流路20g、20hの各一端に対応して配設され一端同士を連結する連結路21c、および縁部には一对の流路穴21d、21eがそれぞれ形成され、各連結路21aないし21cにより各流路20aないし20hが連通されることにより熱交換流体流路22が形成される。そして、これらは図2(B)に示すように、例えばろう付け等により一体に組み立てられプレート型ヒートシンク23が構成される。

【0025】上記のように構成された実施の形態2におけるプレート型ヒートシンク23では、まず、端板15に絶縁基板等を介して発熱を伴うLSI等の電子部品(図示せず)が搭載される。次いで、入口管16から熱交換流体が流入されると、熱交換流体は穴14aおよび流路穴12dを介して両流路19a、19bの一端側に流入し、両流路19a、19bを分流した後連結路12aで一旦合流して両流路19c、19dの他端側に流入し、両流路19c、19dを分流した後連結路12bで再び合流して両流路19e、19fの一端側に流入する。

【0026】そして、両流路19e、19fを分流した後連結路12cで合流して両流路19g、19hの他端側に流入し、両流路19g、19hを分流した後一端側で合流されて第2の連通板21の流路穴21eを介して第2の流路板20の両流路20g、20hの他端側に流入し、両流路20g、20hを分流した後連結路21cで一旦合流して両流路20e、20fの一端側に流入し、両流路20e、20fを分流した後連結路21bで再び合流して両流路20c、20dの他端側に流入する。そして、両流路20c、20dを分流した後連結路21aで合流して両流路20a、20bの一端側に流入

し、両流路20a、20bを分流した後合流されて各流路穴21d、19i、12eおよび穴14bを介して出口管17から流出され、各流路19aないし19hおよび20aないし20h、すなわち両熱交換流体流路24、22を流通する間に、端板15を介して熱交換流体と電子部品との間の熱交換が行われ電子部品は冷却される。

【0027】このように上記実施の形態2によれば、両熱交換流体流路24、22を流れる熱交換流体の流動経路が逆パターンとなるように、各流路19aないし19hおよび20aないし20hが連通されているので、一方の熱交換流体流路24では流路19a、19b→19c、19d→19e、19f→19g、19hの順で流れる熱交換流体の温度は高くなり、他方の熱交換流体流路22では流路20g、20h→20e、20f→20c、20d→20a、20bの順で流れる熱交換流体の温度は高くなる。すなわち、第2の連通板21を介して隣接する熱交換流体流路24、22間の一方側では、一番温度の低い流路19a、19bと一番温度の高い流路20a、20bが、他方側では一番温度の高い流路19g、19hと一番温度の低い流路20g、20hがそれぞれ対応した位置となり、全面にわたって温度が平均化され冷却される電子部品の温度も均一化されるため、電気特性のばらつきもなくなり信頼性の向上を図ることができる。

【0028】実施の形態3。図3はこの発明の実施の形態3におけるプレート型ヒートシンクの構成を示す分解斜視図である。なお、図中矢印は熱交換流体の流通方向を示す。図から明らかなように、本実施の形態3におけるプレート型ヒートシンク25は、図2で示した実施の形態2におけるプレート型ヒートシンク23とほぼ同様であるので、同一符号を付して説明を省略するが、実施の形態2とは逆に入口管16が穴14bに、出口管17が穴14aにそれぞれ連結され、熱交換流体の流れが逆となっている。

【0029】上記のように構成された実施の形態3におけるプレート型ヒートシンク25では、まず、端板15に絶縁基板等を介して発熱を伴うLSI等の電子部品（図示せず）が搭載される。次いで、入口管16から熱交換流体が流入されると、熱交換流体は穴14bおよび各流路穴12e、19i、12dを介して熱交換流体流路22に流入し、熱交換流体流路22内で分流、合流を繰り返した後、流路穴21eを介して熱交換流体流路24に流入し、上記と同様に分流、合流を繰り返した後流路穴12dおよび穴14aを介して出口管17から流出される。そして、両熱交換流体流路22、24内を流通する間に、端板15を介して熱交換流体と電子部品との間の熱交換が行われ電子部品は冷却される。

【0030】このように上記実施の形態3によれば、両熱交換流体流路24、22を流れる熱交換流体の流動経

路が逆パターンとなるように、各流路19aないし19hおよび20aないし20hが連通されているので、一方の熱交換流体流路24では流路19g、19h→19e、19f→19c、19d→19a、19bの順で流れる熱交換流体の温度は高くなり、他方の熱交換流体流路22では流路20a、20b→20c、20d→20e、20f→20g、20hの順で流れる熱交換流体の温度は高くなる。すなわち、第2の連通板21を介して隣接する熱交換流体流路24、22間の一方側では、一番温度の低い流路19g、19hと一番温度の高い流路20g、20hが、他方側では一番温度の高い流路19a、19bと一番温度の低い流路20a、20bがそれぞれ対応した位置となり、全面にわたって温度が平均化され冷却される電子部品の温度も均一化されるため、電気特性のばらつきもなくなり信頼性の向上を図ることができる。

【0031】実施の形態4。図4はこの発明の実施の形態4におけるプレート型ヒートシンクの構成を示す分解斜視図である。なお、図中矢印は熱交換流体の流通方向を示す。図において、図2に示す実施の形態2と同様な部分は同一符号を付して説明を省略する。26は複数の流路26aないし26hがスリット状に並行して形成され、また、縁部の連通板12の流路穴12eと対応する位置に流路穴26iが形成された第1の流路板で、各流路26aないし26hは各連結路12aないし12cで連結されて熱交換流体流路27を構成する。28は第1の流路板26と同様に複数の流路28aないし28hがスリット状に並行して形成された第2の流路板である。

【0032】29は第1および第2の流路板26、28間に介在される第2の連通板で、流路板28の各一对の流路28e、28fと流路28g、28hの各他端に対応して配設され各他端同士を連結する連結路29a、各一对の流路28c、28dと流路28e、28fの各一端に対応して配設され各一端同士を連結する連結路29b、各一对の流路28a、28bと流路28c、28dの各他端に対応して配設され他端同士を連結する連結路29c、および縁部の対角線上には一对の流路穴29d、29eがそれぞれ形成され、各連結路29aないし29cにより各流路28aないし28hが連通されることにより熱交換流体流路30が形成される。そして、これらは例えらう付け等により一体に組み立てられプレート型ヒートシンク31が構成される。

【0033】上記のように構成された実施の形態4におけるプレート型ヒートシンク31では、まず、端板15に絶縁基板等を介して発熱を伴うLSI等の電子部品（図示せず）が搭載される。次いで、入口管16から熱交換流体が流入されると、熱交換流体は穴14aおよび各流路穴12dを介して熱交換流体流路27に流入し、熱交換流体流路27内で分流、合流を繰り返した後、流路穴29dを介して熱交換流体流路30に流入し、上記

と同様に分流、合流を繰り返した後各流路穴29e、26i、12eおよび穴14bを介して出口管17から流出される。そして、両熱交換流体流路27、30内を流通する間に、端板15を介して熱交換流体と電子部品との間の熱交換が行われ電子部品は冷却される。

【0034】このように上記実施の形態4によれば、両熱交換流体流路27、30を流れる熱交換流体の流動経路が逆パターンとなるように、各流路26aないし26hおよび28aないし28hが連通されているので、一方の熱交換流体流路27では流路26a、26b→26c、26d→26e、26f→26g、26hの順で流れる熱交換流体の温度は高くなり、他方の熱交換流体流路30では流路28g、28h→28e、28f→28c、28d→28a、28bの順で流れる熱交換流体の温度は高くなる。すなわち、第2の連通板29を介して隣接する熱交換流体流路27、30間の一方側では、一番温度の低い流路26a、26bと一番温度の高い流路28a、28bが、他方側では一番温度の高い流路26g、26hと一番温度の低い流路28g、28hがそれぞれ対応した位置となり、しかも熱交換流体の流れが逆となり、全面にわたって温度が平均化され冷却される電子部品の温度も均一化されるため、電気特性のばらつきもなくなり信頼性の向上を図ることができる。

【0035】実施の形態5。図5はこの発明の実施の形態5におけるプレート型ヒートシンクの構成を示す分解斜視図である。なお、図中矢印は熱交換流体の流通方向を示す。図から明らかなように、本実施の形態5におけるプレート型ヒートシンク32は、図4で示した実施の形態4におけるプレート型ヒートシンク31とはほぼ同様であるので、同一符号を付して説明を省略するが、実施の形態4とは逆に入口管16が穴14bに、出口管17が穴14aにそれぞれ連結され、熱交換流体の流れが逆となっている。

【0036】上記のように構成された実施の形態5におけるプレート型ヒートシンク32では、まず、端板15に絶縁基板等を介して発熱を伴うLSI等の電子部品（図示せず）が搭載される。次いで、入口管16から熱交換流体が流入されると、熱交換流体は穴14bおよび各流路穴12e、26i、29eを介して熱交換流体流路30に流入し、熱交換流体流路30内で分流、合流を繰り返した後、流路穴29dを介して熱交換流体流路27に流入し、上記と同様に分流、合流を繰り返した後各流路穴12dおよび穴14aを介して出口管17から流出される。そして、両熱交換流体流路27、30内を流通する間に、端板15を介して熱交換流体と電子部品との間の熱交換が行われ電子部品は冷却される。

【0037】このように上記実施の形態5によれば、両熱交換流体流路27、30を流れる熱交換流体の流動経路が逆パターンとなるように、各流路26aないし26hおよび28aないし28hが連通されているので、

方の熱交換流体流路27では流路26g、26h→26e、26f→26c、26d→26a、26bの順で流れる熱交換流体の温度は高くなり、他方の熱交換流体流路28では流路28a、28b→28c、28d→28e、28f→28g、28hの順で流れる熱交換流体の温度は高くなる。すなわち、第2の連通板29を介して隣接する熱交換流体流路27、30間の一方側では、一番温度の低い流路28a、28bと一番温度の高い流路26a、26bが、他方側では一番温度の高い流路28g、28hと一番温度の低い流路26g、26hがそれぞれ対応した位置となり、しかも熱交換流体の流れが逆となり、全面にわたって温度が平均化され冷却される電子部品の温度も均一化されるため、電気特性のばらつきもなくなり信頼性の向上を図ることができる。

【0038】実施の形態6。図6はこの発明の実施の形態6におけるプレート型ヒートシンクの構成を示す分解斜視図、図7は図6におけるプレート型ヒートシンクの外観を示す斜視図、図8は図6におけるプレート型ヒートシンクの構成を示す断面図である。なお、図中矢印は熱交換流体の流通方向を示す。図において、上記各実施例と同様な部分は同一符号を付して説明を省略する。33は複数の流路33aないし33hがスリット状に並行して形成された第1の流路板、34は複数の流路34aないし34hがスリット状に並行して形成された第2の流路板であり、第1および第2の流路板33、34の各流路33a～33hと34a～34hとは図8に示すように投影断面が重ならない位置にそれぞれ形成されている。

【0039】35は第1および第2の流路板33、34間に介在される連通板で、第1の流路板33の各一对の流路33a、33bと流路33c、33dおよび各一对の流路34a、34bと流路34c、34dの各一端に対応して配設され各一端同士を連結する連結路35a、各一对の流路33c、33dと流路33e、33fおよび各一对の流路34c、34dと流路34e、34fの各他端に対応して配設され各他端同士を連結する連結路35b、各一对の流路33e、33fと流路33g、33hおよび各一对の流路34e、34fと流路34g、34hの各一端に対応して配設され一端同士を連結する連結路35c、および縁部には一对の流路穴35d、35eがそれぞれ形成され、各連結路35aないし35cにより各流路33aないし33hおよび34aないし34hがそれぞれ連通され熱交換流体流路36、37が構成される。そして、これらは図7に示すように、例えばろう付け等により一体に組み立てられプレート型ヒートシンク38が構成される。

【0040】上記のように構成された実施の形態6におけるプレート型ヒートシンク38では、まず、端板15に絶縁基板等を介して発熱を伴うLSI等の電子部品39が図8に示すように搭載される。次いで、入口管16

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から熱交換流体が流入されると、熱交換流体は穴14aを介してその一部は流路33a、33bの他端側に、又、残りはさらに流路穴35dを介して流路34a、34bの他端側にそれぞれ流入し、それぞれ両流路33a、33bおよび34a、34bを分流した後、連結路35aで一旦合流して両流路33c、33dおよび34c、34dの一端側に流入し、両流路33c、33dおよび34c、34dを分流した後連結路35bで再び合流して、両流路33e、33fおよび34e、34fの一端側に流入する。

【0041】そして、両流路33e、33fおよび34e、34fを分流した後連結路35cで合流して、両流路33g、33hおよび34g、34hの他端側に流入し、両流路33g、33hおよび34g、34hを分流する。その後、両流路34g、34hを分流した熱交換流体は流路穴35eを介して両流路33g、33hの他端側で、両流路33g、33hを分流する熱交換流体と合流され穴14bを介して出口管17から流出され、各流路33aないし33hおよび34aないし34b、すなわち両熱交換流体流路36、37を流通する間に、端板15を介して熱交換流体と電子部品39との間の熱交換が行われ電子部品39は冷却される。

【0042】このように上記実施の形態6によれば、両熱交換流体流路36および37を構成する各流路33aないし33hおよび34aないし34hを、お互いに投影断面が重ならない位置にそれぞれ形成しているので、電子部品39から離れた位置に配置された各流路33aないし33hから電子部品39に至る熱の伝導経路を直線的に形成できるため、この熱の伝導経路の伝導熱抵抗が著しく低減され、電子部品39から放出される熱を、電子部品39に近い側の熱交換流体流路37からは勿論のこと、離れた側の熱交換流体流路36からも効率よく熱交換をすることが可能となり、冷却性能を向上させることができる。

【0043】実施の形態7、図9はこの発明の実施の形態7におけるプレート型ヒートシンクの構成を示す分解斜視図である。図において、40は複数の流路40aないし40fがスリット状に並行して、また、縁部には一対の流路穴40g、40hがそれぞれ形成された第1の流路板、41は複数の流路41aないし41fがスリット状に並行して形成された第2の流路板、42は第1の流路板40の第2の流路板41とは異なる側に配設された第1の連通板で、第1の流路板40の各一対の流路40a、40bと流路40c、40dの各一端に対応して配設され各一端同士を連結する連結路42a、各一対の流路40cと40dと流路40e、40fの各他端に対応して配設され各他端同士を連結する連結路42b、および縁部には第1の流路板40の両流路穴40g、40hと対応する位置にそれぞれ一対の流路穴42c、42dおよび42e、42fがそれぞれ形成されている。

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【0044】43は第1および第2の流路板40、41間に介在させる第2の連通板で、第2の流路板41の各一対の流路41a、41bと流路41c、41dの各他端に対応して配設され各他端同士を連結する連結路43a、各一対の流路41c、41dと流路41e、41fの各一端に対応して配設され各一端同士を連結する連結路43b、および縁部には第1の流路板40の両流路穴40g、40hと対応する位置に流路穴43c、43dがそれぞれ形成されている。そして、各流路40aないし40fが両連結路42a、42bで連結されて連通することにより熱交換流体流路44が、又、各流路41aないし41fが両連結路43a、43bで連結されて連通することにより熱交換流体流路45がそれぞれ形成される。

【0045】46、47はこれら第1の連通板42、第1の流路板40、第2の連通板43および第2の流路板41を両側から挟持する一対の端板で、一方の端板46には第1の連通板42の各流路穴42cないし42fと対応する位置に穴46aないし46dが形成され、これら各穴46a、46bには入口管48、49が、又、各穴46c、46dには出口管50、51がそれぞれ連結されている。そして、これらは図示はしないが例えばろう付け等により一体に組み立てられプレート型ヒートシンク52が構成される。

【0046】上記のように構成された実施の形態7におけるプレート型ヒートシンク52では、まず、端板47に絶縁基板等を介して発熱を伴うLSI等の電子部品（図示せず）が搭載される。次いで、両入口管48、49から熱交換流体が流入されると、一方の入口管48から流入された熱交換流体は、穴46aおよび各流路穴42d、40g、43cを介して第2の流路板41の一対の流路41e、41fの一端側に流入し熱交換流体流路45内を循環した後、一対の流路41a、41bの他端側から各流路穴43d、40h、42eおよび穴46cを介して出口管50から流出される。

【0047】又、他方の入口管49から流入された熱交換流体は、穴46bおよび流路穴42cを介して第1の流路板40の一対の流路40a、40bの一端側に流入し、熱交換流体流路44内を循環した後、一対の流路40e、40fの他端側から流路穴42fおよび穴46dを介して出口管51から流出される。このようにして両熱交換流体流路44、45内を熱交換流体が流通する間に、端板47を介して熱交換流体と電子部品との間の熱交換が行われ電子部品は冷却される。

【0048】このように上記実施の形態7によれば、一方の熱交換流体流路44では流路40a、40b→40c、40d→40e、40fの順で流れる熱交換流体の温度が高くなり、他方の熱交換流体流路45では流路41e、41f→41c、41d→41a、41bの順で流れる熱交換流体の温度が高くなるように、すなわち、

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両熱交換流体流路44、45を流れる熱交換流体の流動経路が逆パターンとなるように熱交換流体の流通方向を設定しているため、第2の連通板43を介して隣接する両熱交換流体流路44、45間の一方側では、一番温度の低い流路40a、40bと一番温度の高い流路41a、41bが、他方側では一番温度の高い流路40e、40fと一番温度の低い流路41e、41fがそれぞれ対応した位置となり、全面にわたって温度が平均化され冷却される電子部品の温度も均一化されるため、電気特性のばらつきもなくなり信頼性の向上を図ることができる。

【0049】実施の形態8. 図10はこの発明の実施の形態8におけるプレート型ヒートシンクの構成を示す分解斜視図である。図において、53は複数の流路53aないし53fがスリット状に並行して、又、縁部には一対の流路穴53g、53hがそれぞれ形成された流路板、54はこの流路板53の一侧に配設される第1の連通板で、両流路穴53g、53hと対応する位置に一対の流路穴54a、54bが形成されるとともに、奇数番目の各流路53a、53c、53eの一端側をそれぞれ20 連結する連結路54c、および偶数番目の各流路53b、53d、53fの他端側をそれぞれ連結する連結路54dがそれぞれ形成されている。

【0050】55は流路板53の他側に配設される第2の連通板で、奇数番目の各流路53a、53c、53eの他端側をそれぞれ連結する連結路55aおよび偶数番目の各流路53b、53d、53fの一端側をそれぞれ連結する連結路55bがそれぞれ形成されている。そして、奇数番目の流路53a、53c、53eが両連結路54c、55aで連結されて連通することにより第1の30 並列熱交換流体流路56が、又、偶数番目の流路53b、53d、53fが両連結路54d、55bで連結されて連通することにより第2の並列熱交換流体流路57がそれぞれ形成される。

【0051】58、59は第1の連通板54、流路板53および第2の連通板55を両側から挟持する一対の端板で、一方の端板58には第1の連通板54の各流路穴54a、54bおよび連結路54c、54dの一端とそれぞれ対応する位置に穴58aないし58dが形成され、これら各穴58a、58cには入口管60、76 40 が、又、各穴58b、58dには出口管61、62がそれぞれ連結されている。そして、これらは図示はしないが例えばろう付け等により一体に組み立てられプレート型ヒートシンク63が構成される。

【0052】上記のように構成された実施の形態8におけるプレート型ヒートシンク63では、まず、端板59に絶縁基板等を介して発熱を伴うLSI等の電子部品（図示せず）が搭載される。次いで、両入口管60、76から熱交換流体が流入されると、一方の入口管60から流入された熱交換流体は、穴58aおよび各流路穴5

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4a、53gを介して第2の連通板55の連結路55bに流入し、ここで分流して偶数番目の流路53b、53d、53f、すなわち第2の並列熱交換流体流路57を並列に流通した後、第1の連通板54の連結路54dで再び合流し穴58dを介して出口管62から流出される。

【0053】又、他方の入口管76から流入された熱交換流体は、穴58cおよび各流路穴54b、53hを介して第2の連通板55の連結路55aに流入し、ここで分流して奇数番目の流路53a、53c、53e、すなわち第1の並列熱交換流体流路56内を第2の並列熱交換流体流路57とは逆方向に並列に流通した後、第1の連通板54の連結路54cで再び合流し穴58bを介して出口管61から流出される。このようにして両並列熱交換流体流路56、57内を熱交換流体が流通する間に、端板59を介して熱交換流体と電子部品との間の熱交換が行われ電子部品は冷却される。

【0054】このように上記実施の形態8によれば、第1および第2の並列熱交換流体56、57を構成する各流路53a、53c、53eおよび53b、53d、53fを交互に並設し、且つ両並列熱交換流体流路56、57を流れる熱交換流体の流通方向を逆としたので、両並列熱交換流体流路56、57間では、温度の高い熱交換流体と温度の低い熱交換流体とが常に隣接した状態となるため、全面にわたって温度が平均化され冷却される電子部品の温度も均一化されるため、電気特性のばらつきもなくなり信頼性の向上を図ることができる。

【0055】実施の形態9. 図11はこの発明の実施の形態9におけるプレート型ヒートシンクの構成を示す分解斜視図、図12は図11における流路の突起の詳細を示す斜視図、図13は図11におけるプレート型ヒートシンクに電子部品を搭載する位置を説明するための図である。図において、64は複数の流路64aないし64dがスリット状に並行して形成された流路板で、各流路64aないし64dの側壁には図12に示すように複数の突起64eが設けられている。65はこの流路板64の一侧に配設された連通板で、各一対の流路64a、64bと流路64c、64dの各一端に対応して配設され各一端同士を連結する連結路65a、および縁部には一対の流路穴65b、65cがそれぞれ形成されている。40

【0056】そして、各流路64aないし64dが連結路65aで連結されて連通することにより熱交換流体流路66が形成される。67、68はこれら連通板65および流路板64を両側から挟持する一対の端板で、一方の端板67には連通板64の各流路穴65b、65cと対応する位置に穴67a、67bが形成され、穴67aには入口管69が、又、穴67bには出口管70がそれぞれ連結されている。そして、これらは図示はしないが例えばろう付け等により一体に組み立てられプレートシンク71が構成され、又、他方の端板68には絶縁基板

等を介して電子部品72が図13に示すように、突起64eの高さ寸法をh、突起64eから電子部品71のほぼ中心までの寸法をLとすると、 $5h \leq L \leq 12h$ が満足されるような位置に搭載される。

【0057】上記のように構成された実施の形態9におけるプレート型ヒートシンク71では、まず、入口管69から熱交換流体が流入されると、この熱交換流体は穴67aおよび流路穴65bを介して流路板64の一对の流路64a、64bの他端側に流入し、熱交換流体流路66内を循環した後一对流路64c、64d一端側から流路穴65cおよび穴67bを介して出口管70から流出される。このようにして熱交換流体流路66内を流通する間に、端板68を介して熱交換流体と電子部品72との間の熱交換が行われ電子部品72は冷却される。

【0058】そして、上記のように熱交換流体が熱交換流体流路66内を流通する時、熱交換流体は各流路64aないし64dの側壁に設けられた突起64eによって、その流れは一旦流路壁を離れた後流路壁に再付着する。この再付着する位置は流速に関係なく、突起64eの高さ寸法hの5倍〜12倍だけ下流の位置であり、又、再付着位置での熱伝達率が同じ流路内における他の位置での熱伝達率に比べて著しく大きな値を示すことが実験により確認された。

【0059】このように上記実施の形態9によれば、各流路64aないし64dの側壁に複数の突起64eを設けるとともに、これら各突起64eから $5h \leq L \leq 12h$ が満足されるような距離だけ離れた下流の位置に、電子部品72の中心がほぼ合致するように搭載させているので、熱伝達率の大きな電子部品72のほぼ中心で熱交換が一番活発に行われるため、極めて簡単な構造で冷却性能の向上を図ることができる。

【0060】実施の形態10。尚、上記実施の形態9では、流路板64の各流路64aないし64dの側壁の一部を突出させて各突起64eを形成するようにしているが、図14に示すように、上記各実施の形態に適用される各連通板の半分の厚さで形成された一对の連通板73、74を適用し、流路板75と接する側の連通板74の板面の流路板75の各流路の側壁と対応する位置に、例えばエッチングやパンチプレス等で切り起し部74aを形成して折り曲げ、連通板74を流路板75と積み重ねた時に突起として機能させるようにしても良く、上記実施の形態9におけると同様の効果を発揮し得ることは勿論のこと、突起の形成が非常に容易となる。

【0061】実施の形態11。又、上記各実施の形態において、連結される各流路および各連結路の連結部に、熱交換流体の流れに沿った傾斜を設ければ、圧力損失を低減して熱交換流体の流れをスムーズとし、冷却性能の向上を図ることができる。

【0062】実施の形態12。又、上記各実施の形態において、各流路の一部に流路幅の狭い幅狭小部を形成す

れば、熱交換流体の流速を局所的に上昇させて冷却性能の向上を図ることができる。

【0063】実施の形態13。又、上記各実施の形態では、電子部品を一方の端板に搭載させる場合について説明したが、他方の端板あるいは両方の端板に搭載させるようにしても良く、さらに又、入口管および出口管をいずれか一方の端板上に設置する場合について説明したが、ヒートシンクの側面に設置しても良く、上記各実施の形態と同様の効果を発揮し得ることは言うまでもない。

【0064】

【発明の効果】以上のように、この発明の請求項1によれば、複数の独立した流路がスリット状に並行して形成された流路板と、流路板に積重され各流路の相隣なる端部同士を交互に連結することにより各流路を連通して熱交換流体流路を形成する複数の連結路が形成された連通板と、流路板および連通板を両側から挟持する一对の端板とを備えたので、流路板の強度を十分に確保し、自重で曲がって不良品が発生するのを防止することが可能なプレート型ヒートシンクを提供することができる。

【0065】又、この発明の請求項2によれば、複数の独立した流路がスリット状に並行して形成された複数の流路板と、各流路板と交互に積重され各流路の相隣なる端部同士を交互に連結することにより各流路を連通して熱交換流体流路を形成する複数の連結路が形成された複数の連通板と、各流路板および連通板を両側から挟持する一对の端板とを備え、各熱交換流体流路を流れる熱交換流体の流動経路が相隣なるもの同士で逆パターンとなるように各熱交換流体流路を連通させたので、不良品の発生防止が可能であることは勿論のこと、被冷却部品の電気特性のばらつきを抑制して信頼性の向上を図ることが可能なプレート型ヒートシンクを提供することができる。

【0066】又、この発明の請求項3によれば、複数の独立した流路がスリット状に並行し且つ相隣なるものの流路同士の投影断面が重ならない位置に形成された複数の流路板と、各流路板と交互に積重され各流路の相隣なる端部同士を交互に連結することにより各流路を連通して熱交換流体流路を形成する複数の連結路が形成された複数の連通板と、各流路板および連通板を両側から挟持する一对の端板とを備え、各熱交換流体流路を連通させたので、冷却性能を向上させることが可能なプレート型ヒートシンクを提供することができる。

【0067】又、この発明の請求項4によれば、複数の独立した流路がスリット状に並行して形成された複数の流路板と、各流路板と交互に積重され各流路の相隣なる端部同士を交互に連結することにより各流路を連通して熱交換流体流路を形成する複数の連結路が形成された複数の連通板と、各流路板および連通板を両側から挟持する一对の端板とを備え、各熱交換流体流路を流れる熱交

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換流体の流通方向をその流動経路が相隣なるもの同士で逆パターンとなるようにしたので、被冷却部品の電気特性のばらつきを抑制して信頼性の向上を図ることが可能なプレート型ヒートシンクを提供することができる。

【0068】又、この発明の請求項5によれば、複数の独立した流路がスリット状に並行して形成された流路板と、流路板の一侧に積重され流路の奇数番目の各一端側および偶数番目の他端側をそれぞれ連結し第1の並列熱交換流体流路を形成する少なくとも一対の連結路が形成された第1の連通板と、流路板の他側に積重され流路の偶数番目の各一端側および奇数番目の他端側をそれぞれ連結し第2の並列熱交換流体流路を形成する少なくとも一対の連結路が形成された第2の連通板と、第1および第2の連通板を両側から挟持する一対の端板とを備え、第1および第2の並列熱交換流体流路を流れる熱交換流体の流通方向を逆にしたので、被冷却部品の電気特性のばらつきを抑制して信頼性の向上を図ることが可能なプレート型ヒートシンクを提供することができる。

【0069】又、この発明の請求項6によれば、請求項1ないし5のいずれかにおいて、流路壁の一部に突起を形成するとともに突起の高さ寸法の5～12倍の寸法だけ熱交換流体の流れの下流側の位置が中心となるように発熱電子部品を搭載したので、簡単な構造で冷却性能の向上を図ることが可能なプレート型ヒートシンクを提供することができる。

【0070】又、この発明の請求項7によれば、請求項6において、突起は連通板の表面に形成された切り起し部分を折り曲げることによって形成したので、突起を容易に形成することが可能なプレート型ヒートシンクを提供することができる。

【0071】又、この発明の請求項8によれば、請求項1ないし5のいずれかにおいて、各流路と連結路との連結部に熱交換流体の流れに沿って傾斜を設けたので、冷却性能の向上を図ることが可能なプレート型ヒートシンクを提供することができる。

【0072】又、この発明の請求項9によれば、請求項1ないし5のいずれかにおいて、流路の一部に幅狭小部を形成したので、冷却性能の向上を図ることが可能なプレート型ヒートシンクを提供することができる。

【図面の簡単な説明】

【図1】 この発明の実施の形態1におけるプレート型ヒートシンクの構成を示し、(A)は分解斜視図、(B)は外観を示す斜視図である。

【図2】 この発明の実施の形態2におけるプレート型ヒートシンクの構成を示し、(A)は分解斜視図、(B)は外観を示す斜視図である。

【図3】 この発明の実施の形態3におけるプレート型ヒートシンクの構成を示す分解斜視図である。

【図4】 この発明の実施の形態4におけるプレート型

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ヒートシンクの構成を示す分解斜視図である。

【図5】 この発明の実施の形態5におけるプレート型ヒートシンクの構成を示す分解斜視図である。

【図6】 この発明の実施の形態6におけるプレート型ヒートシンクの構成を示す分解斜視図である。

【図7】 図6におけるプレート型ヒートシンクの外観を示す斜視図である。

【図8】 図6におけるプレート型ヒートシンクの構成を示す断面図である。

【図9】 この発明の実施の形態7におけるプレート型ヒートシンクの構成を示す分解斜視図である。

【図10】 この発明の実施の形態8におけるプレート型ヒートシンクの構成を示す分解斜視図である。

【図11】 この発明の実施の形態9におけるプレート型ヒートシンクの構成を示す分解斜視図である。

【図12】 図11における流路の突起の詳細を示す斜視図である。

【図13】 図11におけるプレート型ヒートシンクに電子部品を搭載する位置を説明するための図である。

【図14】 この発明の実施の形態10におけるプレート型ヒートシンクの主要部の構成を示す分解斜視図である。

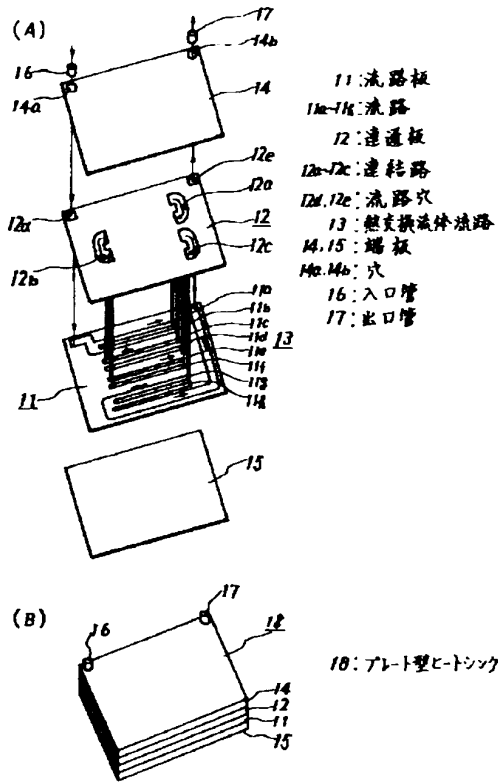
【図15】 従来のプレート型ヒートシンクの構成を示す分解斜視図である。

【図16】 図15におけるプレート型ヒートシンクの外観を示す斜視図である。

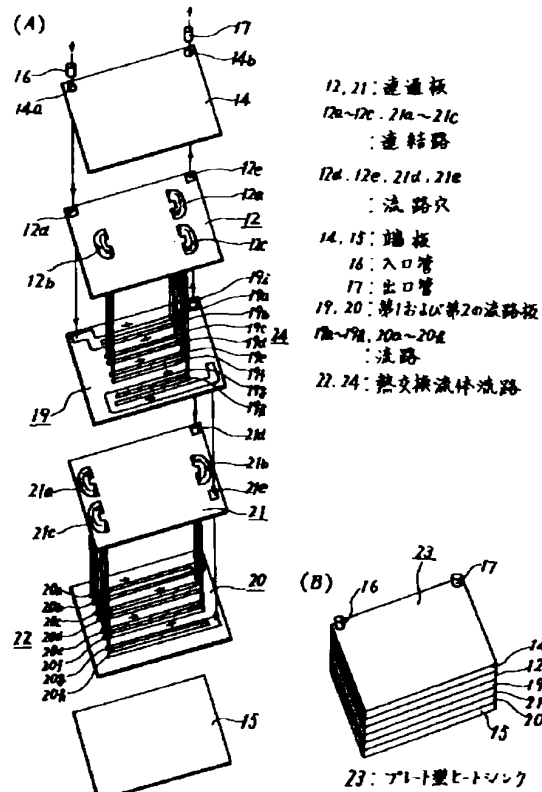
【符号の説明】

11, 53, 64, 75 流路板、11a～11h, 19a～19h, 20a～20h, 26a～26h, 28a～28h, 33a～33h, 34a～34h, 40a～40f, 41a～41h, 53a～53f, 64a～64d 流路、12, 21, 29, 35, 65, 73, 74 連通板、12a～12c, 21a～21c, 29a～29c, 35a～35c, 42a, 42b, 43a, 43b, 54c, 54d, 55a, 55b, 65a 連結路、12d, 12e, 21d, 21e, 19i, 29d, 29e, 35d, 35e, 40g, 40h, 42c～42f, 43c, 43d, 53g, 53h, 54a, 54b, 65b, 65c 流路穴、13, 22, 24, 27, 30, 36, 37, 44, 45, 66 熱交換流体流路、14, 15, 46, 47, 58, 59, 67, 68 端板、16, 48, 49, 60, 69, 76 入口管、17, 50, 51, 61, 62, 70 出口管、18, 23, 25, 31, 32, 38, 52, 63, 71 プレート型ヒートシンク、19, 26, 33, 40 第1の流路板、20, 28, 34, 41 第2の流路板、39, 72 電子部品、42, 54 第1の連通板、43, 55 第2の連通板、64e 突起、74e 切り起し部。

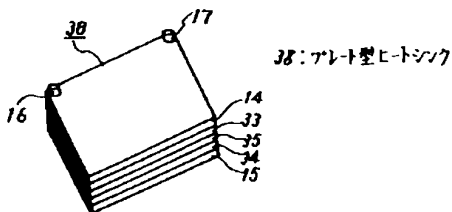
【図1】



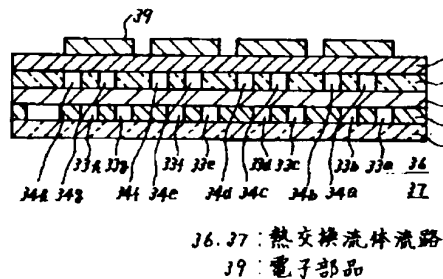
【図2】



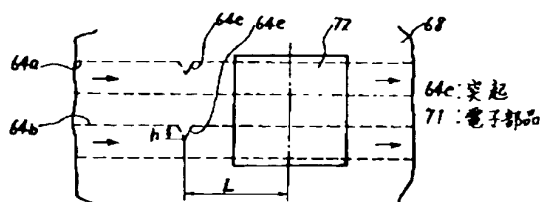
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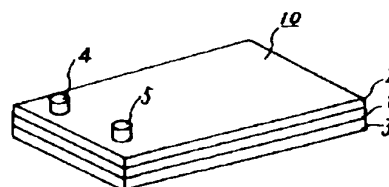
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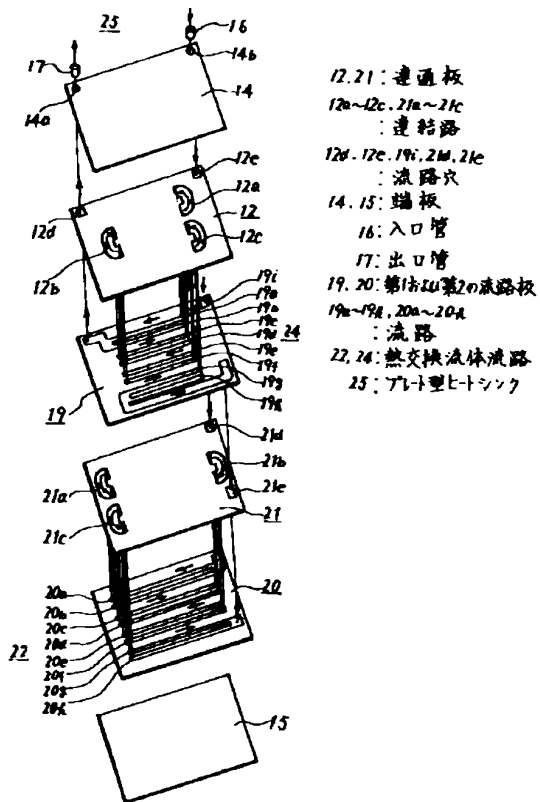
【図13】



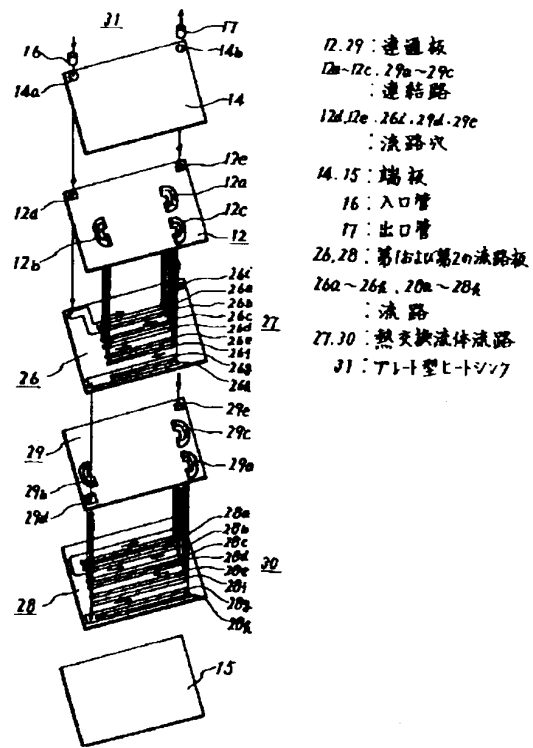
【図16】



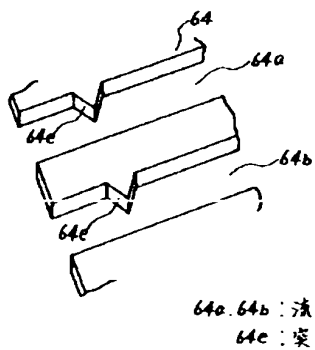
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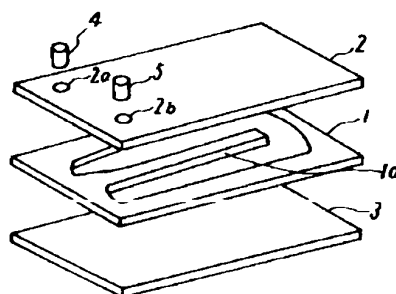
【図4】



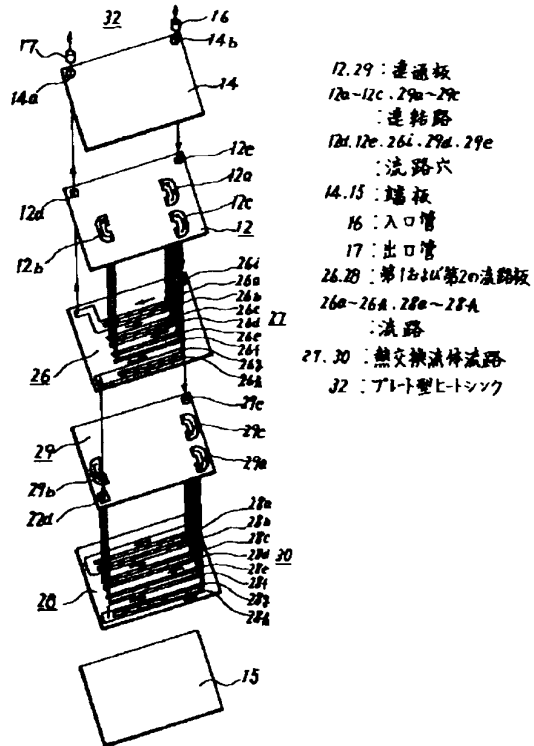
【図12】



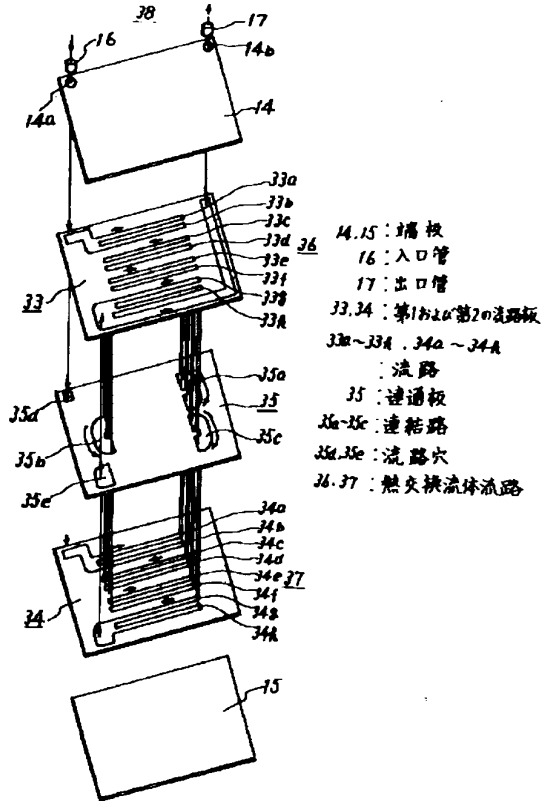
【図15】



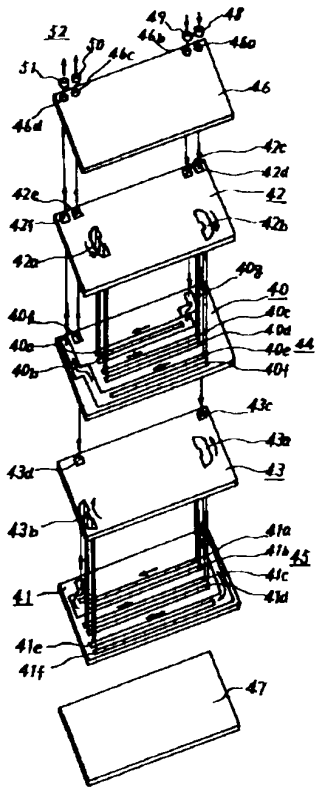
【図5】



【図6】

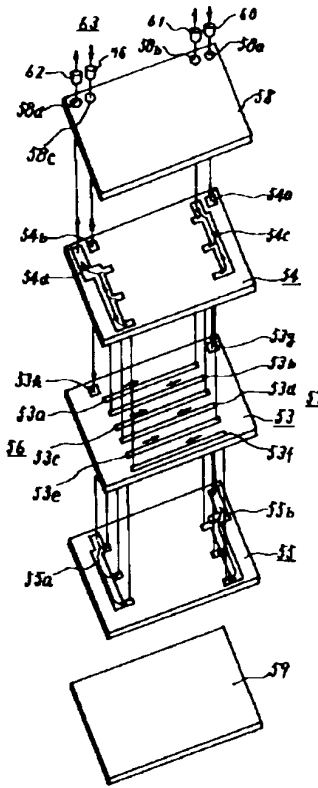


【図9】



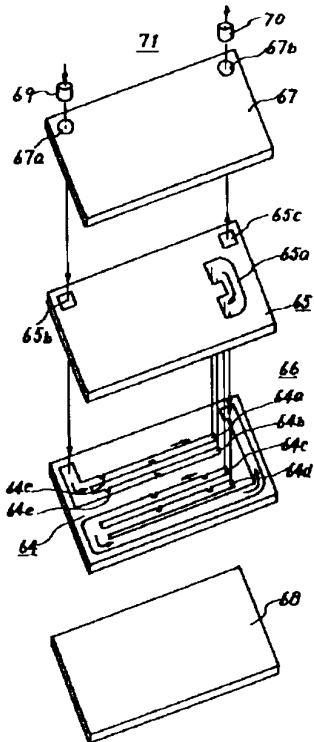
- 40, 41: 第1および第2の流路板
 40a-40f, 41a-41f
 : 流路
 40g, 40h, 42c-42f, 43c, 43d
 : 流路穴
 42, 43: 第1および第2の通板
 42a, 42b, 43a, 43b
 : 連結路
 44, 45: 熱交換液体流路
 46, 47: 端板
 48, 49: 入口管
 50, 51: 出口管
 52: プレート型ヒートシンク

【図10】



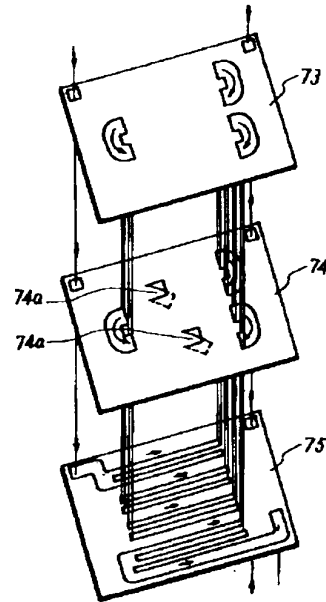
- 53: 流路板
 53a-53f: 流路
 53g, 53h, 54a, 54b
 : 流路穴
 54, 55: 第1および第2の通板
 54c, 54d, 55a, 55b
 : 連結路
 56, 57: 第1および第2の
 熱交換液体流路
 58, 59: 端板
 60, 61: 入口管
 62, 63: 出口管
 63: プレート型ヒートシンク

【図11】



- 64 : 流路板
 64a-64d : 流路
 64e : 突起
 65 : 連通板
 65a : 連結路
 65b, 65c : 流路穴
 66 : 熱交換液体流路
 67, 68 : 端板
 69 : 入口管
 70 : 出口管
 71 : プレート型ヒートシンク

【図14】



- 73, 74 : 連通板
 74a : 切り起し部
 75 : 流路板

フロントページの続き

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Prim. ref.

CLIPPEDIMAGE= JP409102568A

PAT-NO: JP409102568A

DOCUMENT-IDENTIFIER: JP 09102568 A

TITLE: PLATE TYPE HEAT SINK

PUBN-DATE: April 15, 1997

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COUNTRY

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N/A

APPL-NO: JP07258750

APPL-DATE: October 5, 1995

INT-CL (IPC): H01L023/473

ABSTRACT:

PROBLEM TO BE SOLVED: To prevent the occurrence of non-conforming products, to improve the reliability of mounted equipment and the mounted equipment cooling ability of a plate type heat sink by forming a plurality of flow passage plates and a communicative plates on which connecting sections forming flow passages for heat exchanging fluid and holding the flow passage plates and communicative plates between a pair of end plates.

SOLUTION: Flow passage plates 11 are formed by arranging a plurality of independent flow passages 11a-11d in parallel in a slit-like state. Then communicative plates 12 on which connecting paths 12a-12c forming flow passages 13 for heat exchanging fluid by communicating the flow passages 11a-11d with

each other by connecting the adjacent end sections of the flow passages 11a-11d which are alternately pile up upon the plates. The plates 11 and 12 are held between a pair of end plates 14 and 15. Then the flow passages 13 are communicated with each other so that a heat exchanging fluid flowing through the flow passages 13 can form opposite patterns when the fluid flows through adjacent flow passages.

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DERWENT-ACC-NO: 1997-278741
DERWENT-WEEK: 199725
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TITLE: Plate type heat sink for electronic components - supports connection plates and flow path plates by pair of end plates

PATENT-ASSIGNEE: MITSUBISHI ELECTRIC CORP[MITQ]

PRIORITY-DATA: 1995JP-0258750 (October 5, 1995)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
JP 09102568 A	April 15, 1997	N/A	015	H01L 023/473

APPLICATION-DATA:

PUB-NO	APPL-DESCRIPTOR	APPL-NO	APPL-DATE
JP09102568A	N/A	1995JP-0258750	October 5, 1995

INT-CL (IPC): H01L023/473

ABSTRACTED-PUB-NO: JP09102568A

BASIC-ABSTRACT: The heat sink has multiple independent flow paths (19a-19h, 20a-20h) formed using several flow path plates (19, 20). The terminations of alternate flow plates are coupled and multiple coupling paths (12a-12c, 21a-21c) are formed. The independent flow paths together make heat exchange fluid flow paths (22, 24).

The flow path plates are connected to multiple connection plates (12, 21). Each connection plate and each flow path plate are supported from both sides by a pair of end plates (14, 15). An entrance or exit is provided on the end plates. The flow direction of the heat exchange fluid in adjacent flow paths are in opposite directions.

ADVANTAGE - Ensures strength of flow plates. Prevents bend by fare weights. Prevents dispersion of electrical properties of cooling fluid. Improves cooling performance and provides simple structure. Improves reliability.

CHOSEN-DRAWING: Dwg.2/16

TITLE-TERMS:

PLATE TYPE HEAT SINK ELECTRONIC COMPONENT SUPPORT CONNECT
PLATE FLOW PATH PLATE
PAIR END PLATE

DERWENT-CLASS: U11

EPI-CODES: U11-D02A;

SECONDARY-ACC-NO:

Non-CPI Secondary Accession Numbers: N1997-231015

PATENT ABSTRACTS OF JAPAN

(11)Publication number : **09-102568**

(43)Date of publication of application : **15.04.1997**

(51)Int.Cl.

H01L 23/473

(21)Application number : **07-258750**

(71)Applicant : **MITSUBISHI ELECTRIC CORP**

(22)Date of filing : **05.10.1995**

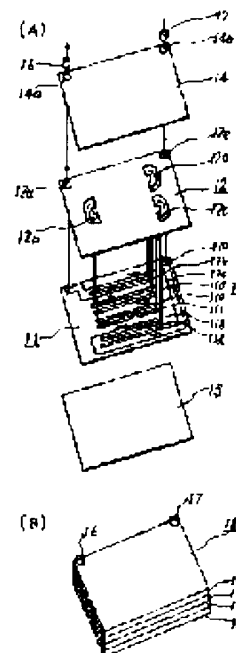
(72)Inventor : **HAYASHI KENICHI
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OGUSHI TETSURO
MATSUMOTO HIDEO**

(54) PLATE TYPE HEAT SINK

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent the occurrence of non-conforming products, to improve the reliability of mounted equipment and the mounted equipment cooling ability of a plate type heat sink by forming a plurality of flow passage plates and a communicative plates on which connecting sections forming flow passages for heat exchanging fluid and holding the flow passage plates and communicative plates between a pair of end plates.

SOLUTION: Flow passage plates 11 are formed by arranging a plurality of independent flow passages 11a-11d in parallel in a slit-like state. Then communicative plates 12 on which connecting paths 12a-12c forming flow passages 13 for heat exchanging fluid by communicating the flow passages 11a-11d with each other by connecting the adjacent end sections of the flow passages 11a-11d which are alternately pile up upon the plates. The plates 11 and 12 are held between a pair of end plates 14 and 15. Then the flow passages 13 are communicated with each other so that a heat exchanging fluid flowing through the flow passages 13 can form opposite patterns when the fluid flows through adjacent flow passages.



LEGAL STATUS

[Date of request for examination] 08.02.2000

[Date of sending the examiner's decision of rejection] 29.05.2001

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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3. In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] it ****s to the passage board with which the passage where plurality became independent was formed in parallel to the shape of a slit, and the above-mentioned passage board -- having -- each above-mentioned passage -- adjacency -- by connecting edges by turns with the free passage board with which two or more connection ways which open each above-mentioned passage for free passage and form heat-exchange fluid passage were formed The plate type heat sink characterized by having the end plate of the couple which pinches the above-mentioned passage board and a free passage board from both sides.

[Claim 2] the flow path of the heat-exchange fluid which is equipped with the following and flows each above-mentioned heat-exchange fluid passage -- adjacency -- the plate type heat sink characterized by making each above-mentioned heat-exchange fluid passage open for free passage so that it may become a reverse pattern by things Two or more passage boards with which the passage where plurality became independent was formed in parallel to the shape of a slit. it ****s each above-mentioned passage board and by turns -- having -- each above-mentioned passage -- adjacency -- two or more free passage boards with which two or more connection ways which open each above-mentioned passage for free passage and form heat-exchange fluid passage by connecting edges by turns were formed The end plate of the couple which pinches each above-mentioned passage board and a free passage board from both sides.

[Claim 3] The plate type heat sink which is equipped with the following and characterized by making each above-mentioned heat-exchange fluid passage open for free passage. the passage where plurality became independent -- the shape of a slit -- concurrent -- and -- adjacency -- two or more passage boards formed in the position with which the projection cross section of the above-mentioned passage of a thing does not lap it ****s each above-mentioned passage board and by turns -- having -- each above-mentioned passage -- adjacency -- two or more free passage boards with which two or more connection ways which open each above-mentioned passage for free passage and form heat-exchange fluid passage by connecting edges by turns were formed The end plate of the couple which pinches each above-mentioned passage board and a free passage board from both sides.

[Claim 4] the circulation direction of the heat-exchange fluid which is equipped with the following and flows each above-mentioned heat-exchange fluid passage -- the flow path -- adjacency -- the plate type heat sink characterized by making it become a reverse pattern by things Two or more passage boards with which the passage where plurality became independent was formed in parallel to the shape of a slit. it ****s each above-mentioned passage board and by turns -- having -- each above-mentioned passage -- adjacency -- two or more free passage boards with which two or more connection ways which open each above-mentioned passage for free passage and form heat-exchange fluid passage by connecting edges by turns were formed The end plate of the couple which pinches each above-mentioned passage board and a free passage board from both sides.

[Claim 5] The plate type heat sink which is equipped with the following and characterized by making reverse the circulation direction of the heat-exchange fluid which flows the above 1st and the 2nd parallel heat-exchange fluid passage. The passage board with which the passage where plurality became independent was formed in parallel to the shape of a slit. The 1st which is accumulated on the unilateral of the above-mentioned passage board, connects an one odd-numbered one end of the above-mentioned passage / each, and even-numbered other end side, respectively, and forms the 1st parallel heat-exchange fluid passage] free passage board in which the connection way of a couple was formed at least. The 2nd which is accumulated on a side besides the above-mentioned passage board, connects an one even-numbered one end of the above-mentioned passage / each, and odd-numbered other end side, respectively, and forms the 2nd parallel heat-exchange fluid passage] free passage board in which the connection way of a couple was formed at least. The end plate of the couple which pinches the above 1st and the 2nd free passage board from both sides.

[Claim 6] The plate type heat sink according to claim 1 to 5 with which the size of the above-mentioned salient 5 to 12 times the size of height is characterized by the position of the downstream of the flow of a heat-exchange fluid carrying exoergic electronic parts so that the lead may be taken while forming a salient in some passage walls.

[Claim 7] A salient is a plate type heat sink according to claim 6 characterized by being formed by [which start and bends a portion] having been formed in the front face of a free passage board.

[Claim 8] The plate type heat sink according to claim 1 to 5 characterized by preparing an inclination in the connection section of each passage and a connection way in accordance with the flow of a heat-exchange fluid.

[Claim 9] The plate type heat sink according to claim 1 to 5 characterized by forming the narrow small section in a part of passage.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the plate type heat sink from which the heat which applies to the device accompanied by generation of heat like electronic parts, and is generated is removed.

[0002]

[Description of the Prior Art] The decomposition perspective diagram and drawing 16 which show the composition of this kind with which drawing 15 is shown in JP.6-76872.B of conventional plate type heat sink are the perspective diagram showing the appearance of the plate type heat sink in drawing 15. In drawing, the passage board with which, as for 1, passage 1a to which a heat-exchange fluid flows was formed, and 2 and 3 are the end plates which pinch this passage board 1 from both sides, and the holes 2a and 2b which are open for free passage, respectively to the entrance side and outlet side of passage 1a of the passage board 1 are formed in one end plate 2. 4 and 5 are the inlet pipes and outlet pipes which are connected with these holes 2a and 2b, and as shown in drawing 16, these are assembled by one by soldering etc. and constitute the plate type heat sink 10.

[0003] In the conventional plate type heat sink constituted as mentioned above, electronic parts (not shown), such as LSI accompanied by generation of heat, are carried in an end plate 3 through an insulating substrate etc. And after circulating passage 1a which the heat-exchange fluid flowed from the inlet pipe 4, and was formed in the passage board 1, by making it flow out of an excurrent canal 5, the heat exchange between a heat-exchange fluid and electronic parts is performed through an end plate 3, and electronic parts are cooled. In addition, through piping connected to the outlet pipe 5, it is led to a cooling system, and is cooled, and the heat-exchange fluid which flowed out of the outlet pipe 5 although illustration was not carried out flows in the plate type heat sink 10 from an inlet pipe 4 again with a pump.

[0004]

[Problem(s) to be Solved by the Invention] Since the conventional plate type heat sink was constituted as mentioned above, when passage 1a moved the inside of the passage board 1 in a zigzag direction thinly, the intensity of the passage board 1 became small by passage 1a, and there was a trouble that passage 1a bent with a self-weight, and a defective occurred.

[0005] Moreover, by the heat exchange, since temperature rises as for a lower stream of a river, as for the heat-exchange fluid which flows the inside of passage 1a, in that by which the electronic parts carried in the end plate 3 are similarly carried in the downstream, temperature rises. Consequently, the temperature of electronic parts varies by the helicopter loading site. On the other hand, since the electrical property of electronic parts was strongly influenced to temperature, when the temperature of electronic parts varied, dispersion arose also in the electrical property, it becomes impossible to have demonstrated the predetermined performance and it had the trouble that reliability fell.

[0006] Moreover, although it was also possible to have increased the heat-exchange fluid flow and to reduce the own temperature rise of a heat-exchange fluid in order to make dispersion in the temperature of electronic parts small, according to this method, the pump for making it circulate, since a flow rate and pressure loss increase was enlarged, and there was a trouble of becoming disadvantageous [from a viewpoint of ** space nature] also in cost.

[0007] There was a trouble that a processing top is difficult for making passage 1a move in a zigzag direction intricately further again, and it was difficult to aim at improvement in a cooling performance since especially the thing for which a three-dimensional path is formed is difficult.

[0008] This invention was accomplished in order to cancel the above troubles, and it aims at offering the plate type heat sink which can aim at improvement in the reliability of prevention of defective generating, and a loading device, and a cooling performance.

[0009]

[Means for Solving the Problem] The plate type heat sink concerning the claim 1 of this invention it ****s to the passage board with which the passage where plurality became independent was formed in parallel to the shape of a slit, and a passage board -- having -- each passage -- adjacency -- by connecting edges by turns with the free passage board with which two or more connection ways which open each passage for free passage and form heat-exchange fluid passage were formed It has the end plate of the couple which pinches a passage board and a free passage board from both sides.

[0010] Moreover, the plate type heat sink concerning the claim 2 of this invention Two or more passage boards with which the passage where plurality became independent was formed in parallel to the shape of a slit, it ****s each passage board and

by turns -- having -- each passage -- adjacency -- by connecting edges by turns with two or more free passage boards with which two or more connection ways which open each passage for free passage and form heat-exchange fluid passage were formed the flow path of the heat-exchange fluid which is equipped with the end plate of the couple which pinches each passage board and a free passage board from both sides, and flows each heat-exchange fluid passage -- adjacency -- each heat-exchange fluid passage is made to open for free passage so that it may become a reverse pattern by things

[0011] Moreover, the plate type heat sink concerning the claim 3 of this invention the passage where plurality became independent -- the shape of a slit -- concurrent -- and -- adjacency -- with two or more passage boards formed in the position with which the projection cross section of the passage of a thing does not lap it ****s each passage board and by turns -- having -- each passage -- adjacency -- by connecting edges by turns with two or more free passage boards with which two or more connection ways which open each passage for free passage and form heat-exchange fluid passage were formed It has the end plate of the couple which pinches each passage board and a free passage board from both sides, and each heat-exchange fluid passage is made to open for free passage.

[0012] Moreover, the plate type heat sink concerning the claim 4 of this invention Two or more passage boards with which the passage where plurality became independent was formed in parallel to the shape of a slit, it ****s each passage board and by turns -- having -- each passage -- adjacency -- by connecting edges by turns with two or more free passage boards with which two or more connection ways which open each passage for free passage and form heat-exchange fluid passage were formed the circulation direction of the heat-exchange fluid which is equipped with the end plate of the couple which pinches each passage board and a free passage board from both sides, and flows each heat-exchange fluid passage -- the flow path -- adjacency -- it is made to become a reverse pattern by things

[0013] Moreover, the plate type heat sink concerning the claim 5 of this invention The passage board with which the passage where plurality became independent was formed in parallel to the shape of a slit, and the 1st [which is accumulated on the unilateral of a passage board, connects an one odd-numbered one end / of passage / each, and even-numbered other end side, respectively, and forms the 1st parallel heat-exchange fluid passage] free passage board in which the connection way of a couple was formed at least. The 2nd [which is accumulated on a side besides a passage board, connects an one even-numbered one end / of passage / each, and odd-numbered other end side, respectively, and forms the 2nd parallel heat-exchange fluid passage] free passage board in which the connection way of a couple was formed at least. It has the end plate of the couple which pinches the 1st and 2nd free passage boards from both sides, and the circulation direction of the heat-exchange fluid which flows the 1st and 2nd parallel heat-exchange fluid passage is made reverse.

[0014] Moreover, as for the size of a salient 5 to 12 times the size of height, while the plate type heat sink concerning the claim 6 of this invention forms a salient in some passage walls in a claim 1 or either of 5, the position of the downstream of the flow of a heat-exchange fluid carries exoergic electronic parts so that the lead may be taken.

[0015] Moreover, the plate type heat sink concerning the claim 7 of this invention forms a salient in a claim 6 by [which start and bends a portion] having been formed in the front face of a free passage board.

[0016] Moreover, the plate type heat sink concerning the claim 8 of this invention prepares an inclination in the connection section of each passage and a connection way in accordance with the flow of a heat-exchange fluid in a claim 1 or either of 5.

[0017] Moreover, the plate type heat sink concerning the claim 9 of this invention forms the narrow small section in a part of passage in a claim 1 or either of 5.

[0018]

[Embodiments of the Invention]

It is the perspective diagram in which gestalt 1, drawing 1 of operation shows the composition of the plate type heat sink in the gestalt 1 of implementation of this invention. (A) shows a decomposition perspective diagram and (B) shows appearance. In addition, the arrow in drawing shows the circulation direction of a heat-exchange fluid. They are the passage board with which passage 11a of plurality [11] or 11h were formed in parallel to the shape of a slit in drawing, and the free passage board with which 12 is accumulated on this passage board 11. Connection way 12a which is arranged corresponding to one a pair each of passage 11a and 11b of the passage board 11, and Passage [11c and 11d] edge each, and connects one edges each, Connection way 12b which is arranged corresponding to each a pair each of passage 11c and 11d, and Passage [11e and 11f] other end, and connects each other ends. The passage holes 12d and 12e of a couple are formed in connection way 12c which is arranged corresponding to one a pair each of passage 11e and 11f, and Passage [11g and 11h] edge each, and connects one edges each, and the marginal part, respectively.

[0019] And when each passage 11a or 11h are opened for free passage by each [these] connection way 12a or 12c, the heat-exchange fluid passage 13 is formed. 14 and 15 are the end plates of the couple which pinches these passage board 11 and the free passage board 12 from both sides, and the holes 14a and 14b which are open for free passage, respectively are formed in one end plate 14 through both the passage holes 12d and 12e the other end [of both the passage 11a and 11b], and both passage [11g and 11h] end side. 16 and 17 are the inlet pipes and outlet pipes which are connected with each [these] holes 14a and 14b, respectively, as these show drawing 1 (B), it is assembled by one by soldering etc. and the plate type heat sink 18 is constituted.

[0020] In the plate type heat sink 18 in the gestalt 1 of the operation constituted as mentioned above, electronic parts (not shown), such as LSI accompanied by generation of heat, are first carried in an end plate 15 through an insulating substrate etc. If a heat-exchange fluid flows from an inlet pipe 16, a heat-exchange fluid minds hole 14a and 12d of passage holes. Subsequently, both passage 11a, It flows into the other end side of 11b, after shunting both the passage 11a and 11b, it once

joins by connection way 12a, and flows into a both passage [11c and 11d] end side, and after shunting both the passage 11c and 11d, it joins again by connection way 12b, and flows into a both passage [11e and 11f] other end side.

[0021] And after joining by connection way 12c, flowing into a both passage [11g and 11h] end side, after shunting both the passage 11e and 11f, and shunting both the passage 11g and 11h, it joins by the other end side and flows out of an outlet pipe 17 through passage hole 12e and hole 14b. Thus, while circulating in each passage 11a or 11h13, i.e., heat-exchange fluid passage, the heat exchange between a heat-exchange fluid and electronic parts is performed through an end plate 15, and electronic parts are cooled. In addition, although illustration is not carried out, through piping connected to the outlet pipe 17, it is led to a cooling system and cooled, and it circulates through the heat-exchange fluid which flowed out of the outlet pipe 17 to an inlet pipe 16 side again with a pump, and it flows in the plate type heat sink 18.

[0022] Thus, slit-like passage 11a or 11h which the plurality formed in the passage board 11 became independent of about the heat-exchange fluid passage 13 according to the gestalt 1 of the above-mentioned implementation, it forms in the free passage board 12 -- having -- each [these] passage 11a or 11h -- adjacency, since edges are constituted from connection way 12a or 12c connected by turns. Since the configuration of the heat-exchange fluid passage 13 is simplified comparatively and the intensity of the passage board 11 can also fully be secured, it can prevent that bend by self-weight and a defective occurs.

[0023] It is the perspective diagram in which gestalt 2, drawing 2 of operation shows the composition of the plate type heat sink in the gestalt 2 of implementation of this invention. (A) shows a decomposition perspective diagram and (B) shows appearance. In addition, the arrow in drawing shows the circulation direction of a heat-exchange fluid. In drawing, the same portion as the gestalt 1 of operation shown in drawing 1 attaches the same sign, and omits explanation. Two or more passage 19a or 19h are formed in parallel to the shape of a slit, and 19 is passage hole 12e of the free passage board 12 of a marginal part, and the 1st passage board with which passage hole 19i was formed in the corresponding position, it is connected by each connection way 12a or 12c, and each passage 19a or 19h of heat-exchange fluid passage 24 are constituted. 20 is the 1st passage board 19 and the 2nd passage board with which two or more passage 20a or 20h were similarly formed in parallel to the shape of a slit.

[0024] 21 is the 1st and the 2nd passage board 19, and the 2nd free passage board that intervenes among 20. Connection way 21a which is arranged corresponding to one a pair each of passage 20a and 20b of the passage board 20, and Passage [20c and 20d] edge each, and connects one edges each, Connection way 21b which is arranged corresponding to each a pair each of passage 20c and 20d, and Passage [20e and 20f] other end, and connects each other ends, Connection way 21c which is arranged corresponding to one a pair each of passage 20e and 20f, and Passage [20g and 20h] edge each, and connects ends. And the passage holes 21d and 21e of a couple are formed in a marginal part, respectively, and when each passage 20a or 20h are opened for free passage by each connection way 21a or 21c, the heat-exchange fluid passage 22 is formed. And as these show drawing 2 (B), it is assembled by one by soldering etc. and the plate type heat sink 23 is constituted.

[0025] In the plate type heat sink 23 in the gestalt 2 of the operation constituted as mentioned above, electronic parts (not shown), such as LSI accompanied by generation of heat, are first carried in an end plate 15 through an insulating substrate etc. If a heat-exchange fluid flows from an inlet pipe 16, a heat-exchange fluid minds hole 14a and 12d of passage holes.

Subsequently, both passage 19a, It flows into the end side of 19b, after shunting both the passage 19a and 19b, it once joins by connection way 12a, and flows into a both passage [19c and 19d] other end side, and after shunting both the passage 19c and 19d, it joins again by connection way 12b, and flows into a both passage [19e and 19f] end side.

[0026] After shunting both the passage 19e and 19f, it joins by connection way 12c, 19g of and both passage, It flows into a 19h other end side, and after shunting both the passage 19g and 19h, it joins by the end side and passage hole 21e of the 2nd free passage board 21 is minded. 20g of both passage of the 2nd passage board 20, It flows into a 20h other end side, after shunting both the passage 20g and 20h, it once joins by connection way 21c, and flows into a both passage [20e and 20f] end side, and after shunting both the passage 20e and 20f, it joins again by connection way 21b, and flows into a both passage [20c and 20d] other end side. After shunting both the passage 20c and 20d, it joins by connection way 21a. And both passage 20a, It flows into the end side of 20b, and it joins, after shunting both the passage 20a and 20b, 21d of each passage hole. While flowing out of an outlet pipe 17 through 19i, 12e, and hole 14b and circulating in each passage 19a, 19h and 20a, or 20h 24 and 22, i.e., both heat-exchanges fluid passage, the heat exchange between a heat-exchange fluid and electronic parts is performed through an end plate 15, and electronic parts are cooled.

[0027] Thus, since according to the gestalt 2 of the above-mentioned implementation each passage 19a, 19h and 20a, or 20h are opened for free passage so that the flow path of the heat-exchange fluid which flows both the heat-exchanges fluid passage 24 and 22 may serve as a reverse pattern. In one heat-exchange fluid passage 24, passage 19a, 19b->19c, 19d->19e. The temperature of the heat-exchange fluid which flows in order (19f->19g and 19h) becomes high, and the temperature of the heat-exchange fluid which flows in order of 20g of passage, 20h->20e, 20f->20c, 20d->20a, and 20b becomes high in the heat-exchange fluid passage 22 of another side, namely, in the one side of a between [the heat-exchange fluid passage 24 which adjoins through the 2nd free passage board 21, and 22] Most the low passage 19a and 19b and the passage 20a and 20b where temperature is the highest of temperature. In the other side, most, it becomes the passage 19g and 19h where temperature is the highest, and the position where the low passage 20g and 20h of temperature corresponded, respectively, and since the temperature of the electronic parts which temperature is equalized and are cooled is also equalized over the whole surface, dispersion in an electrical property is also lost and improvement in reliability can be aimed at.

[0028] Gestalt 3, drawing 3 of operation is the decomposition perspective diagram showing the composition of the plate type heat sink in the gestalt 3 of implementation of this invention. In addition, the arrow in drawing shows the circulation direction

of a heat-exchange fluid. Since the plate type heat sink 25 in the gestalt 3 of this operation is the same as the plate type heat sink 23 in the gestalt 2 of operation shown by drawing 2 almost so that clearly from drawing, although the same sign is attached and explanation is omitted, conversely, an inlet pipe 16 is connected with hole 14b, an outlet pipe 17 is connected with hole 14a, respectively, and the gestalt 2 of operation has the reverse flow of a heat-exchange fluid.

[0029] In the plate type heat sink 25 in the gestalt 3 of the operation constituted as mentioned above, electronic parts (not shown), such as LSI accompanied by generation of heat, are first carried in an end plate 15 through an insulating substrate etc. When a heat-exchange fluid flows from an inlet pipe 16, a heat-exchange fluid Subsequently, hole 14b and each passage hole 12e, It flows into the heat-exchange fluid passage 22 through 19i and 12d, in the heat-exchange fluid passage 22 Diverging, After repeating unification, it flows into the heat-exchange fluid passage 24 through passage hole 21e, and after repeating diverging and unification like the above, it flows out of an outlet pipe 17 through 12d of passage holes, and hole 14a. And while circulating the inside of both the heat-exchanges fluid passage 22 and 24, the heat exchange between a heat-exchange fluid and electronic parts is performed through an end plate 15, and electronic parts are cooled.

[0030] Thus, since according to the gestalt 3 of the above-mentioned implementation each passage 19a, 19h and 20a, or 20h are opened for free passage so that the flow path of the heat-exchange fluid which flows both the heat-exchanges fluid passage 24 and 22 may serve as a reverse pattern In one heat-exchange fluid passage 24, 19g of passage, 19h->19e, 19f->19c, The temperature of the heat-exchange fluid which flows in order of 19d->19a and 19b becomes high, and the temperature of the heat-exchange fluid which flows in order (passage 20a, 20b->20c, 20d->20e, 20f->20g, and 20h) becomes high in the heat-exchange fluid passage 22 of another side, namely, in the one side of a between [the heat-exchange fluid passage 24 which adjoins through the 2nd free passage board 21, and 22] Most the low passage 19g and 19h and the passage 20g and 20h where temperature is the highest of temperature In the other side, most, it becomes the passage 19a and 19b where temperature is the highest, and the position where the low passage 20a and 20b of temperature corresponded, respectively, and since the temperature of the electronic parts which temperature is equalized and are cooled is also equalized over the whole surface, dispersion in an electrical property is also lost and improvement in reliability can be aimed at.

[0031] Gestalt 4, drawing 4 of operation is the decomposition perspective diagram showing the composition of the plate type heat sink in the gestalt 4 of implementation of this invention. In addition, the arrow in drawing shows the circulation direction of a heat-exchange fluid. In drawing, the same portion as the gestalt 2 of operation shown in drawing 2 attaches the same sign, and omits explanation. Two or more passage 26a or 26h are formed in parallel to the shape of a slit, and 26 is passage hole 12e of the free passage board 12 of a marginal part, and the 1st passage board with which passage hole 26i was formed in the corresponding position, it is connected by each connection way 12a or 12c, and each passage 26a or 26h of heat-exchange fluid passage 27 are constituted, 28 is the 1st passage board 26 and the 2nd passage board with which two or more passage 28a or 28h were similarly formed in parallel to the shape of a slit.

[0032] 29 is the 1st and the 2nd passage board 26, and the 2nd free passage board that intervenes among 28. Connection way 29a which is arranged corresponding to each a pair each of passage 28e and 28f of the passage board 28, and Passage [28g and 28h] other end, and connects each other ends, Connection way 29b which is arranged corresponding to one a pair each of passage 28c and 28d, and Passage [28e and 28f] edge each, and connects one edges each, Connection way 29c which is arranged corresponding to each a pair each of passage 28a and 28b, and Passage [28c and 28d] other end, and connects the other ends, And on the diagonal line of a marginal part, the passage holes 29d and 29e of a couple are formed, respectively, and when each passage 28a or 28h are opened for free passage by each connection way 29a or 29c, the heat-exchange fluid passage 30 is formed. And these are assembled by one by soldering etc. and the plate type heat sink 31 is constituted.

[0033] In the plate type heat sink 31 in the gestalt 4 of the operation constituted as mentioned above, electronic parts (not shown), such as LSI accompanied by generation of heat, are first carried in an end plate 15 through an insulating substrate etc. Subsequently, if a heat-exchange fluid flows from an inlet pipe 16, a heat-exchange fluid will flow into the heat-exchange fluid passage 27 through hole 14a and 12d of each passage hole. After repeating diverging and unification in the heat-exchange fluid passage 27, it flows into the heat-exchange fluid passage 30 through 29d of passage holes, and after repeating diverging and unification like the above, it flows out of an outlet pipe 17 through each passage holes 29e, 26i, and 12e and hole 14b. And while circulating the inside of both the heat-exchanges fluid passage 27 and 30, the heat exchange between a heat-exchange fluid and electronic parts is performed through an end plate 15, and electronic parts are cooled.

[0034] Thus, since according to the gestalt 4 of the above-mentioned implementation each passage 26a, 26h and 28a, or 28h are opened for free passage so that the flow path of the heat-exchange fluid which flows both the heat-exchanges fluid passage 27 and 30 may serve as a reverse pattern In one heat-exchange fluid passage 27, passage 26a, 26b->26c, 26d->26e, The temperature of the heat-exchange fluid which flows in order (26f->26g and 26h) becomes high, and the temperature of the heat-exchange fluid which flows in order of 28g of passage, 28h->28e, 28f->28c, 28d->28a, and 28b becomes high in the heat-exchange fluid passage 30 of another side, namely, in the one side of a between [the heat-exchange fluid passage 27 which adjoins through the 2nd free passage board 29, and 30] Most the low passage 26a and 26b and the passage 28a and 28b where temperature is the highest of temperature In the other side, with the passage 26g and 26h where temperature is the highest, most 28g of low passage of temperature, 28h becomes the position which corresponded, respectively, moreover the flow of a heat-exchange fluid becomes reverse, since the temperature of the electronic parts with which temperature is equalized and cooled over the whole surface is also equalized, dispersion in an electrical property can also be lost and improvement in reliability can be aimed at.

[0035] Gestalt 5, drawing 5 of operation is the decomposition perspective diagram showing the composition of the plate type

heat sink in the gestalt 5 of implementation of this invention. In addition, the arrow in drawing shows the circulation direction of a heat-exchange fluid. Since the plate type heat sink 32 in the gestalt 5 of this operation is the same as the plate type heat sink 31 in the gestalt 4 of operation shown by drawing 4 almost so that clearly from drawing, although the same sign is attached and explanation is omitted, conversely, an inlet pipe 16 is connected with hole 14b, an outlet pipe 17 is connected with hole 14a, respectively, and the gestalt 4 of operation has the reverse flow of a heat-exchange fluid.

[0036] In the plate type heat sink 32 in the gestalt 5 of the operation constituted as mentioned above, electronic parts (not shown), such as LSI accompanied by generation of heat, are first carried in an end plate 15 through an insulating substrate etc. When a heat-exchange fluid flows from an inlet pipe 16, a heat-exchange fluid Subsequently, hole 14b and each passage hole 12e, It flows into the heat-exchange fluid passage 30 through 26i and 29e, in the heat-exchange fluid passage 30 Diverging. After repeating unification, it flows into the heat-exchange fluid passage 27 through 29d of passage holes, and after repeating diverging and unification like the above, it flows out of an outlet pipe 17 through 12d of each passage hole, and hole 14a. And while circulating the inside of both the heat-exchanges fluid passage 27 and 30, the heat exchange between a heat-exchange fluid and electronic parts is performed through an end plate 15, and electronic parts are cooled.

[0037] Thus, since according to the gestalt 5 of the above-mentioned implementation each passage 26a, 26h and 28a, or 28h are opened for free passage so that the flow path of the heat-exchange fluid which flows both the heat-exchanges fluid passage 27 and 30 may serve as a reverse pattern In one heat-exchange fluid passage 27, 26g of passage, 26h->26e, 26f->26c, The temperature of the heat-exchange fluid which flows in order of 26d->26a and 26b becomes high, and the temperature of the heat-exchange fluid which flows in order (passage 28a, 28b->28c, 28d->28e, 28f-> 28g, and 28h) becomes high in the heat-exchange fluid passage 28 of another side, namely, in the one side of a between [the heat-exchange fluid passage 27 which adjoins through the 2nd free passage board 29, and 30] Most the low passage 28a and 28b and the passage 26a and 26b where temperature is the highest of temperature In the other side, with the passage 28g and 28h where temperature is the highest, most 26g of low passage of temperature, 26h becomes the position which corresponded, respectively, moreover the flow of a heat-exchange fluid becomes reverse, since the temperature of the electronic parts with which temperature is equalized and cooled over the whole surface is also equalized, dispersion in an electrical property can also be lost and improvement in reliability can be aimed at.

[0038] The decomposition perspective diagram showing the composition of a plate type heat sink [in / the gestalt 6 of implementation of this invention / in gestalt 6, drawing 6 of operation], the perspective diagram showing the appearance of a plate type heat sink / in / drawing 6 / in drawing 7], and drawing 8 are the cross sections showing the composition of the plate type heat sink in drawing 6 . In addition, the arrow in drawing shows the circulation direction of a heat-exchange fluid. In drawing, the same portion as each above-mentioned example attaches the same sign, and omits explanation. The 1st passage board with which passage 33a of plurality [33] or 33h were formed in parallel to the shape of a slit, Two or more passage 34a or 34h are the 2nd passage board formed in parallel to the shape of a slit, and 34 is formed in the position with which a projection cross section does not lap as it is indicated in drawing 8 as each passage 33a-33h of the 1st and 2nd passage boards 33 and 34, and 34a-34h, respectively.

[0039] 35 is the 1st and the 2nd passage board 33, and the free passage board that intervenes among 34. A pair each of passage 33a and 33b of the 1st passage board 33, Passage 33c and 33d, and a pair each passage 34a, Connection way 35a which is arranged corresponding to one 34b and Passage [34c and 34d] edge each, and connects one edges each. A pair each of passage 33c and 33d, Passage 33e and 33f, and a pair each passage 34c, Connection way 35b which is arranged corresponding to each 34d and Passage [34e and 34f] other end, and connects each other ends, A pair each of passage 33e and 33f, Passage 33g and 33h, and a pair each passage 34e, Connection way 35c which is arranged corresponding to one 34f and Passage [34g and 34h] edge each, and connects ends, And the passage holes 35d and 35e of a couple are formed in a marginal part, respectively, each passage 33a, 33h and 34a, or 34h are opened for free passage by each connection way 35a or 35c, respectively, and the heat-exchange fluid passage 36 and 37 is constituted. And as these show drawing 7 , it is assembled by one by soldering etc. and the plate type heat sink 38 is constituted.

[0040] In the plate type heat sink 38 in the gestalt 6 of the operation constituted as mentioned above, first, as the electronic parts 39, such as LSI accompanied by generation of heat, show an end plate 15 through an insulating substrate etc. at drawing 8 , it is carried. If a heat-exchange fluid flows from an inlet pipe 16, a heat-exchange fluid minds hole 14a, the part Subsequently, passage 33a. The remainder minds [other end ' of 33b] 35d of passage holes further again. Passage 34a, It flows into the other end side of 34b, respectively.. respectively Both the passage 33a, 33b, and 34a, After once joining by connection way 35a, flowing into a both passage [33] and 33d and end (c [34] and 34d) side, after shunting 34b, and shunting both the passage 33c and 33d and 34c and 34d, it joins again by connection way 35b. It flows into a both passage [33] and 33f and end (e [34] and 34f) side.

[0041] And after shunting both the passage 33e and 33f and 34e and 34f, it joins by connection way 35c, and it flows into a both passage [33] and 33h and other end (g [34] and 34h) side, and diverging of both the passage 33g and 33h and 34g and the 34h is carried out. The heat-exchange fluid which shunted both the passage 34g and 34h minds passage hole 35e, then, by the both passage [33g and 33h] other end side Join the heat-exchange fluid which carries out diverging of both the passage 33g and 33h, and it flows out of an outlet pipe 17 through hole 14b. While circulating in each passage 33a, 33h and 34a, or 34b 36 and 37, i.e., both heat-exchanges fluid passage, the heat exchange between a heat-exchange fluid and electronic parts 39 is performed through an end plate 15, and electronic parts 39 are cooled.

[0042] Thus, since each passage 33a which constitutes both the heat-exchanges fluid passage 36 and 37, 33h and 34a, or 34h

are formed in the position where a projection cross section does not lap with each other, respectively according to the gestalt 6 of the above-mentioned implementation. Since the conduction path of heat of resulting [from each passage 33a or 33h] in the electronic parts 39 arranged in the position distant from electronic parts 39 can be formed linearly, the heat with which conductive-heat resistance of the conduction path of this heat is remarkably reduced, and is emitted from electronic parts 39 from the heat-exchange fluid passage 37 of the side near electronic parts 39. It can become possible to carry out a heat exchange efficiently also from the heat-exchange fluid passage 36 by the side of a remote, and a cooling performance can be raised.

[0043] Gestalt 7, drawing 9 of operation is the decomposition perspective diagram showing the composition of the plate type heat sink in the gestalt 7 of implementation of this invention. In drawing, passage 40a of plurality [40] or 40f are concurrent in the shape of a slit. Moreover, the 1st passage board with which the passage holes 40g and 40h of a couple were formed in the marginal part, respectively. The 2nd passage board with which passage 41a of plurality [41] or 41f were formed in parallel to the shape of a slit, and 42 are the 1st free passage board arranged in a side which is different in the 2nd passage board 41 of the 1st passage board 40. Connection way 42a which is arranged corresponding to one a pair each of passage 40a and 40b of the 1st passage board 40, and Passage [40c and 40d] edge each, and connects one edges each. Connection way 42b which is arranged corresponding to each a pair each of passage 40c and 40d, and Passage [40e and 40f] other end, and connects each other ends. And the passage holes 42c and 42d of a couple and 42e and 42f are formed in the position which corresponds to a marginal part with both the passage holes 40g and 40h of the 1st passage board 40, respectively.

[0044] 43 is the 1st and the 2nd passage board 40, and the 2nd free passage board made to intervene among 41. Connection way 43a which is arranged corresponding to each a pair each of passage 41a and 41b of the 2nd passage board 41, and Passage [41c and 41d] other end, and connects each other ends. The passage holes 43c and 43d are formed in connection way 43b which is arranged corresponding to one a pair each of passage 41c and 41d, and Passage [41e and 41f] edge each, and connects one edges each, and the position which corresponds to a marginal part with both the passage holes 40g and 40h of the 1st passage board 40, respectively. And when each passage 40a or 40f are connected on both the connection ways 42a and 42b, and is open for free passage, each passage 41a or 41f are connected on both the connection ways 43a and 43b and the heat-exchange fluid passage 44 is open for free passage again, the heat-exchange fluid passage 45 is formed, respectively. [0045] 46 and 47 are the end plates of the couple which pinches the free passage board 42 of these 1st, the 1st passage board 40, the 2nd free passage board 43, and the 2nd passage board 41 from both sides. Hole 46a or 46d are formed in the position which corresponds to one end plate 46 with each passage hole 42c of the 1st free passage board 42, or 42f, inlet pipes 48 and 49 are connected with each [these] holes 46a and 46b, and outlet pipes 50 and 51 are connected with each holes 46c and 46d again, respectively. And although these do not carry out illustration, it is assembled by one by soldering etc. and the plate type heat sink 52 is constituted.

[0046] In the plate type heat sink 52 in the form 7 of the operation constituted as mentioned above, electronic parts (not shown), such as LSI accompanied by generation of heat, are first carried in an end plate 47 through an insulating substrate etc. If a heat-exchange fluid flows from both the inlet pipes 48 and 49, subsequently, the heat-exchange fluid which flowed from one inlet pipe 48 Hole 46a and each passage holes 42d, 40g, and 43c are minded. Passage 41e of the couple of the 2nd passage board 41. After flowing into a 41f end side and circulating through the inside of the heat-exchange fluid passage 45, it flows out of an outlet pipe 50 through each passage holes 43d, 40h, and 42e from the other end side of the passage 41a and 41b of a couple, and hole 46c.

[0047] Moreover, after the heat-exchange fluid which flowed from the inlet pipe 49 of another side flows into the end side of the passage 40a and 40b of the couple of the 1st passage board 40 through hole 46b and passage hole 42c and circulates through the inside of the heat-exchange fluid passage 44, it flows out of an outlet pipe 51 through 42f of passage holes from a passage [of a couple / 40e and 40f] other end side, and 46d of holes. Thus, while a heat-exchange fluid circulates the inside of both the heat-exchanges fluid passage 44 and 45, the heat exchange between a heat-exchange fluid and electronic parts is performed through an end plate 47, and electronic parts are cooled.

[0048] According to the form 7 of the above-mentioned implementation, in one heat-exchange fluid passage 44. Thus, passage 40a, So that the temperature of 40b->40c, 40d->40e, and the heat-exchange fluid that flows in 40f order may become high and the temperature of the heat-exchange fluid which flows in the heat-exchange fluid passage 45 of another side in order of passage 41e, 41f->41c, 41d->41a, and 41b may become high. Namely, since the circulation direction of a heat-exchange fluid is set up so that the flow path of the heat-exchange fluid which flows both the heat-exchanges fluid passage 44 and 45 may serve as a reverse pattern. In the one side of a between [both the heat-exchanges fluid passage 44 that adjoins through the 2nd free passage board 43, and 45] The passage 40a and 40b where temperature is the lowest, and the passage 41a and 41b where temperature is the highest. In the other side, the passage 40e and 40f where temperature is the highest, and the passage 41e and 41f where temperature is the lowest serve as a position which corresponded, respectively, since the temperature of the electronic parts with which temperature is equalized and cooled over the whole surface is also equalized, dispersion in an electrical property is also lost and improvement in reliability can be aimed at.

[0049] Form 8, drawing 10 of operation is the decomposition perspective diagram showing the composition of the plate type heat sink in the form 8 of implementation of this invention. Passage 53a of plurality [53] or 53f are the passage board with which the passage holes 53g and 53h of a couple were formed on drawing and in parallel to the shape of a slit at the edge, respectively, and the 1st free passage board with which 54 is arranged in the unilateral of this passage board 53. While the passage holes 54a and 54b of a couple are formed in both the passage holes 53g and 53h and a corresponding position 54d of

connection ways which connect a connection way 54c [which connects the odd-numbered end side of each passage 53a, 53c, and 53e, respectively], and even-numbered each passage [53b, 53d, and 53f] other end side, respectively is formed, respectively.

[0050] 55 is the 2nd free passage board arranged in a side besides the passage board 53, and connection way 55b which connects a connection way 55a [which connects the odd-numbered other end side of each passage 53a, 53c, and 53e, respectively], and even-numbered each passage [53b, 53d, and 53f] end side, respectively is formed, respectively. And when the odd-numbered passage 53a, 53c, and 53e is connected on both the connection ways 54c and 55a, and is open for free passage, the even-numbered passage 53b, 53d, and 53f is connected on both the connection ways 54d and 55b and the 1st parallel heat-exchange fluid passage 56 is open for free passage again, the 2nd parallel heat-exchange fluid passage 57 is formed, respectively.

[0051] 58 and 59 are the end plates of the couple which pinches the 1st free passage board 54, the passage board 53, and the 2nd free passage board 55 from both sides. To one end plate 58, each passage holes 54a and 54b and connection way 54c of the 1st free passage board 54, Hole 58a or 58d are formed in a 54d end and the position which corresponds, respectively, inlet pipes 60 and 76 are connected with each [these] holes 58a and 58c, and outlet pipes 61 and 62 are connected with each holes 58b and 58d again, respectively. And although these do not carry out illustration, it is assembled by one by soldering etc. and the plate type heat sink 63 is constituted.

[0052] In the plate type heat sink 63 in the form 8 of the operation constituted as mentioned above, electronic parts (not shown), such as LSI accompanied by generation of heat, are first carried in an end plate 59 through an insulating substrate etc. If a heat-exchange fluid flows from both the inlet pipes 60 and 76, subsequently, the heat-exchange fluid which flowed from one inlet pipe 60 It flows into connection way 55b of the 2nd free passage board 55 through hole 58a and each passage holes 54a and 53g. After shunting here and circulating in parallel in the even-numbered passage 53f [53b, 53d, and] 57, i.e., the 2nd parallel heat-exchange fluid passage, it joins again on 54d of connection ways of the 1st free passage board 54, and flows out of an outlet pipe 62 through 58d of holes.

[0053] Moreover, the heat-exchange fluid which flowed from the inlet pipe 76 of another side It flows into connection way 55a of the 2nd free passage board 55 through hole 58c and each passage holes 54b and 53h. After shunting here and circulating the inside of the odd-numbered passage 53e [53a, 53c, and] 56, i.e., 1st parallel heat-exchange fluid passage, in parallel [the 2nd parallel heat-exchange fluid passage 57] with an opposite direction, it joins again by connection way 54c of the 1st free passage board 54, and flows out of an outlet pipe 61 through hole 58b. Thus, while a heat-exchange fluid circulates the inside of both the parallel heat-exchange fluid passage 56 and 57, the heat exchange between a heat-exchange fluid and electronic parts is performed through an end plate 59, and electronic parts are cooled.

[0054] Thus, each passage 53a which constitutes the 1st and 2nd parallel heat-exchange fluids 56 and 57 according to the gestalt 8 of the above-mentioned implementation, Since the circulation direction of the heat-exchange fluid which installs 53c, 53e, and 53b, 53d, and 53f by turns, and flows both the parallel heat-exchange fluid passage 56 and 57 was made reverse Since a heat-exchange fluid with high temperature and the low heat-exchange fluid of temperature will be in the state where it always adjoined, between both the parallel heat-exchange fluid passage 56 and 57, Since the temperature of the electronic parts with which temperature is equalized and cooled over the whole surface is also equalized, dispersion in an electrical property is also lost and improvement in reliability can be aimed at.

[0055] The decomposition perspective diagram showing the composition of a plate type heat sink [in / the gestalt 9 of implementation of this invention / in gestalt 9, drawing 11 of operation], the perspective diagram showing the detail of a salient of passage / in / drawing 11 / in drawing 12], and drawing 13 are drawings for explaining the position which carries electronic parts in the plate type heat sink in drawing 11 . In drawing, 64 is the passage board with which two or more passage 64a or 64d were formed in parallel to the shape of a slit, and as shown in drawing 12 . two or more salient 64e is prepared in each passage 64a or the 64d side attachment wall. 65 is the free passage board arranged in the unilateral of this passage board 64, and the passage holes 65b and 65c of a couple are formed in connection way 65a which is arranged corresponding to one a pair each of passage 64a and 64b, and Passage [64c and 64d] edge each, and connects one edges each, and the marginal part, respectively.

[0056] And when each passage 64a or 64d are connected by connection way 65a and is open for free passage, the heat-exchange fluid passage 66 is formed. 67 and 68 are the end plates of the couple which pinches these free passage board 65 and the passage board 64 from both sides. Holes 67a and 67b are formed in the position which corresponds to one end plate 67 with each passage holes 65b and 65c of the free passage board 64, an inlet pipe 69 is connected with hole 67a, and the outlet pipe 70 is connected with hole 67b again, respectively. And as it is assembled by soldering etc. at one although these do not carry out illustration, and the plate sink 71 is constituted and it is shown in drawing 13 through an insulating substrate etc. in the other-end board 68, the height size of salient 64e is carried in electronic parts 72 in a position of h and salient 64e to the electronic parts 71 with which it will be satisfied of $5h \leq L \leq 12h$ if the size to a center is mostly set to L.

[0057] In the plate type heat sink 71 in the gestalt 9 of the operation constituted as mentioned above If a heat-exchange fluid flows from an inlet pipe 69, this heat-exchange fluid minds hole 67a and passage hole 65b. First, passage 64a of the couple of the passage board 64, It flows into the other end side of 64b, and after circulating through the inside of the heat-exchange fluid passage 66, it flows out of an outlet pipe 70 through couple passage 64c, passage hole 65 from 64d end side c, and hole 67b. Thus, while circulating the inside of the heat-exchange fluid passage 66, the heat exchange between a heat-exchange fluid and electronic parts 72 is performed through an end plate 68, and electronic parts 72 are cooled.

[0058] And when a heat-exchange fluid circulates the inside of the heat-exchange fluid passage 66 as mentioned above, the reattachment of the flow is carried out to the back passage wall which once left the passage wall by salient 64e by which the heat-exchange fluid was prepared in each passage 64a or the 64d side attachment wall. It was checked by experiment that only 5 times to 12 times of the height size h of salient 64e are a down-stream position, and this position that carries out the reattachment shows a remarkable big value regardless of the rate of flow compared with the heat transfer rate in other positions in the passage where the heat transfer rate in a reattachment position is the same.

[0059] Thus, while preparing two or more salient 64e in each passage 64a or a 64d side attachment wall according to the gestalt 9 of the above-mentioned implementation the position of the lower stream of a river which only the distance L with which it is satisfied of $5h \leq L \leq 12h$ from each [these] salient 64e left -- the center of electronic parts 72 -- almost -- *****. since it is made to carry like Since [of the electronic parts 72 with a big heat transfer rate] a heat exchange is performed mostly most actively at the center, improvement in a cooling performance can be aimed at with very easy structure.

[0060] Although a part of each passage 64a of the passage board 64 or 64d side attachment wall is made to project and it is made to form each salient 64e with the gestalt 9 of gestalt 10. of operation, in addition the above-mentioned implementation As shown in drawing 14, the free passage boards 73 and 74 of the couple formed by the thickness of the half of each free passage board applied to the gestalt of each above-mentioned implementation are applied. In the side attachment wall of each passage of the passage board 75 of the plate surface of the free passage board 74 of the side which touches the passage board 75, and a corresponding position For example, start by etching, the punch press, etc., and section 74a is formed and bent. When the free passage board 74 is accumulated with the passage board 75, it may be made to make it function as a salient, and formation of a salient becomes very easy not to mention the ability to demonstrate the same effect also in the gestalt 9 of the above-mentioned implementation.

[0061] In gestalt 11. of operation, and the gestalt of each above-mentioned implementation, if the inclination in alignment with the flow of a heat-exchange fluid is prepared in the connection section of each passage connected and each connection way, pressure loss can be reduced, the flow of a heat-exchange fluid can be made smooth, and improvement in a cooling performance can be aimed at.

[0062] In gestalt 12. of operation, and the gestalt of each above-mentioned implementation, if the narrow small section with the narrow depth is formed in a part of each passage, the rate of flow of a heat-exchange fluid is raised locally, and improvement in a cooling performance can be aimed at.

[0063] Although gestalt 13. of operation and the gestalt of each above-mentioned implementation explained the case where electronic parts were made to carry in one end plate It may be made to make it carry in an other-end board or both end plates, and although the case where an inlet pipe and an outlet pipe were installed on one of end plates was explained, it cannot be overemphasized further again that you may install in the side of a heat sink and the same effect as the gestalt of each above-mentioned implementation can be demonstrated.

[0064]

[Effect of the Invention] As mentioned above, the passage board with which the passage where plurality became independent was formed in parallel to the shape of a slit according to the claim 1 of this invention, it ***** to a passage board -- having -- each passage -- adjacency, since it had the free passage board with which two or more connection ways which open each passage for free passage and form heat-exchange fluid passage by connecting edges by turns were formed, and the end plate of the couple which pinches a passage board and a free passage board from both sides The intensity of a passage board can fully be secured and the plate type heat sink which can prevent that bend by self-weight and a defective occurs can be offered.

[0065] Moreover, two or more passage boards with which the passage where plurality became independent was formed in parallel to the shape of a slit according to the claim 2 of this invention, it ***** each passage board and by turns -- having -- each passage -- adjacency -- by connecting edges by turns with two or more free passage boards with which two or more connection ways which open each passage for free passage and form heat-exchange fluid passage were formed the flow path of the heat-exchange fluid which is equipped with the end plate of the couple which pinches each passage board and a free passage board from both sides, and flows each heat-exchange fluid passage -- adjacency, since each heat-exchange fluid passage was made to open for free passage so that it may become a reverse pattern by things Not to mention prevention of generating of a defective being possible, the plate type heat sink which dispersion in the electrical property of cooled parts is suppressed, and can aim at improvement in reliability can be offered.

[0066] moreover, the passage where plurality became independent according to the claim 3 of this invention -- the shape of a slit -- concurrent -- and -- adjacency -- with two or more passage boards formed in the position with which the projection cross section of the passage of a thing does not lap it ***** each passage board and by turns -- having -- each passage -- adjacency -- by connecting edges by turns with two or more free passage boards with which two or more connection ways which open each passage for free passage and form heat-exchange fluid passage were formed Since it had the end plate of the couple which pinches each passage board and a free passage board from both sides and each heat-exchange fluid passage was made to open for free passage, the plate type heat sink which can raise a cooling performance can be offered.

[0067] Moreover, two or more passage boards with which the passage where plurality became independent was formed in parallel to the shape of a slit according to the claim 4 of this invention, it ***** each passage board and by turns -- having -- each passage -- adjacency -- by connecting edges by turns with two or more free passage boards with which two or more connection ways which open each passage for free passage and form heat-exchange fluid passage were formed the circulation

direction of the heat-exchange fluid which is equipped with the end plate of the couple which pinches each passage board and a free passage board from both sides, and flows each heat-exchange fluid passage -- the flow path -- adjacency, since it was made to become a reverse pattern by things The plate type heat sink which dispersion in the electrical property of cooled parts is suppressed, and can aim at improvement in reliability can be offered.

[0068] Moreover, the passage board with which the passage where plurality became independent was formed in parallel to the shape of a slit according to the claim 5 of this invention. The 1st [which is accumulated on the unilateral of a passage board, connects an one odd-numbered one end of passage each, and even-numbered other end side, respectively, and forms the 1st parallel heat-exchange fluid passage] free passage board in which the connection way of a couple was formed at least. The 2nd [which is accumulated on a side besides a passage board, connects an one even-numbered one end of passage each, and odd-numbered other end side, respectively and forms the 2nd parallel heat-exchange fluid passage] free passage board in which the connection way of a couple was formed at least. Since the circulation direction of the heat-exchange fluid which is equipped with the end plate of the couple which pinches the 1st and 2nd free passage boards from both sides, and flows the 1st and 2nd parallel heat-exchange fluid passage was made reverse The plate type heat sink which dispersion in the electrical property of cooled parts is suppressed, and can aim at improvement in reliability can be offered.

[0069] Moreover, according to the claim 6 of this invention, in a claim 1 or either of 5, while forming a salient in some passage walls, since the size of a salient 5 to 12 times the size of height carried exoergic electronic parts so that the position of the downstream of the flow of a heat-exchange fluid might take the lead, the plate type heat sink which can aim at improvement in a cooling performance with easy structure can be offered.

[0070] Moreover, since the salient was formed in the claim 6 by [which start and bends a portion] having been formed in the front face of a free passage board according to the claim 7 of this invention, the plate type heat sink which can form a salient easily can be offered.

[0071] Moreover, according to the claim 8 of this invention, in a claim 1 or either of 5, since the inclination was prepared in the connection section of each passage and a connection way in accordance with the flow of a heat-exchange fluid, the plate type heat sink which can aim at improvement in a cooling performance can be offered.

[0072] Moreover, according to the claim 9 of this invention, in a claim 1 or either of 5, since the narrow small section was formed in a part of passage, the plate type heat sink which can aim at improvement in a cooling performance can be offered.